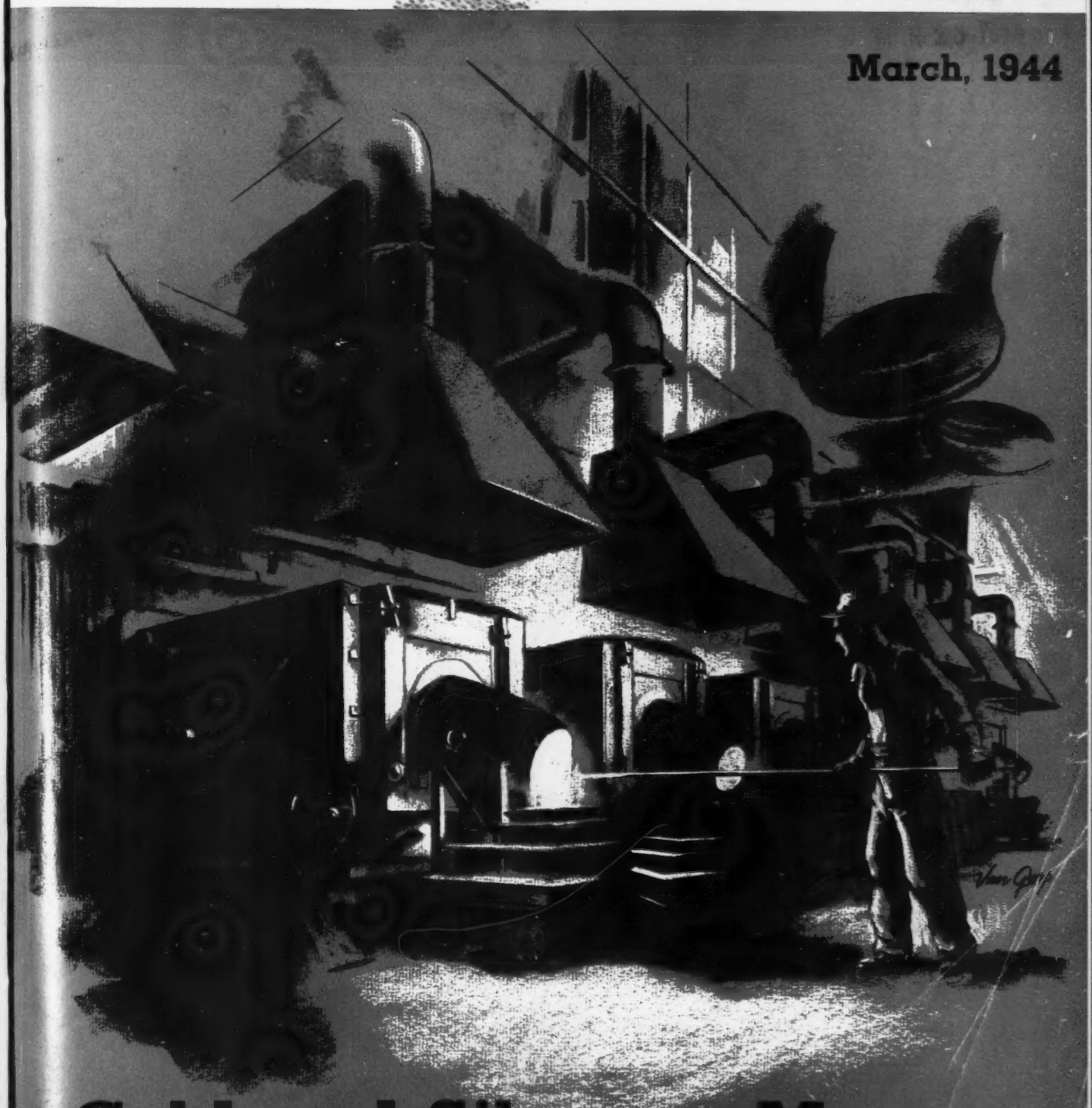
ENGINEERING AND MINING JOURNAL

March, 1944



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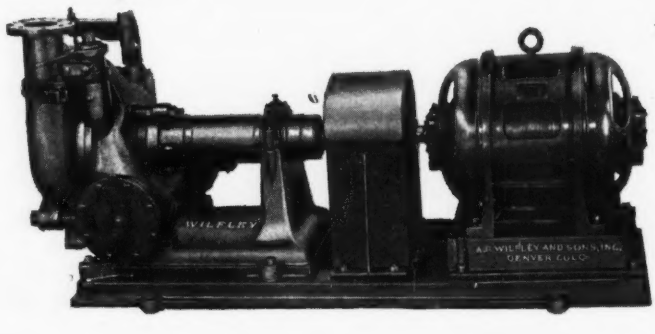

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Disposal of Government Inventories

How to dispose of government surpluses when the war ends need not be an insuperable problem – if we face it promptly and intelligently. But if we do not, peacetime markets may be disrupted, government funds wasted, production discouraged, and reconversion of the whole economy to peace seriously hampered.

What we need most in order to attack the problem is estimates of how much surplus there will be, in what types of goods, and where.

At the war's end, government inventory of war goods is likely to total around 60 billion dollars. Most of this will consist of aircraft, ships, and other ordnance. Only some 15 billion dollars or less will be in food, clothing, trucks, tools, chemicals, medical supplies, transportation, engineering and communication equipment, and other goods for which there is a civilian market.

In addition, war contractors will have about 10 billion dollars of inventories, the bulk in specialized raw materials, goods in process, and finished products. Only about one-fifth of the total, or some 2 billion dollars, will be marketable or usable for civilian purposes. While the government takes over the usable inventory, the ex-war-contractors will have to build up their stocks for peacetime production, so that on balance, they will not be disposing of usable inventories in large volume.

Not even all of the usable war-end inventory will be "surplus" for sale to civilians in competition with new production. Some of it will be needed by the sizable peacetime Army and Navy we are likely to maintain, and such additional items as can be stored without serious deterioration or obsolescence will be held against possible future war emergencies. Some of it will be disposed of abroad. And up to half of it will be abroad and may be sold there or used for relief.

After allowing for these factors, the war supplies to be disposed of in our own markets probably will be less than 10 billion dollars (cost basis). While the total is not overwhelming – the equivalent of two months' retail sales – in certain lines the surplus will be several years', instead of a few months', normal supply. In particular, the volume of scrap metals available from otherwise unusable munitions will present a problem.

A great deal can be done now to reduce the size of the postwar surpluses by achieving a better balance between military needs and supplies and avoiding excessive inventories of particular raw materials or finished goods. This work needs to be pressed, not only to simplify our transition to peace but also to prevent wasting productive energies during the war. Furthermore, when the war ends on one front, inventories of war materiel should be worked down to the reduced scale of remaining military activity.

We cannot develop programs of action until we know approximately how much of each type of item is to be sold, and where and when it will be available. Wide margins of error are inevitable as long as large-scale procurement and large-scale consumption are still taking place; yet such information is essential and must be developed. Indeed, improved inventory records and estimates are badly needed for the conduct of the war as well as for managing the surpluses after hostilities cease.

In decisions on the disposal of war-goods inventories, the public interest must be the prime consideration. Proposals that none of these goods should be sold domestically because of competition with new production obviously are untenable. Everything that is not needed by the Armed Services or for other special purposes should be disposed of ultimately. The real problem is not whether surpluses should be sold, but rather to whom, at what price, and at what time the sale should be effected.

In the distribution of such large quantities of goods, we believe that established trade channels should be used wherever possible. Otherwise, we shall witness widespread speculation in war goods and the mushroom growth of inefficient and disruptive fly-by-night distributors. This will benefit only a few speculators and will discourage legitimate producers and distributors from making their normal commitments.

All war contractors should have the privilege of retaining those inventories for which they are willing to pay actual cost or a fair price negotiated with the gov-

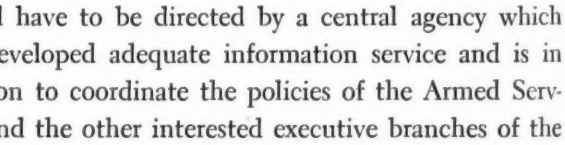
ernment procurement agency. The balance of the inventories in the hands of war producers should be assembled by the government and sold in an organized manner. It is of great importance that the plants be cleared of these inventories at once so that the process of conversion to peacetime operation can proceed without further delay. To accomplish this, preparations must be made before the end of the war for speedy determination of the inventories to be moved and for a huge volume of storage space to accommodate them.

The price which can be realized and the timing of sale are closely related. Certainly the best prices will not be secured if the government attempts to dispose of large supplies of material and products suddenly without regard to market conditions. Most businessmen rightly favor an early transfer of surplus inventories from government to private ownership. But, they also realize that if all the surpluses are dumped indiscriminately as they become available, many markets will be badly depressed, and the resulting low prices will bring lower production. If this depression effect becomes general, as it easily can, it will be costly to the nation in terms of jobs, income, and goods.

In industries in which production is inadequate to meet postwar demands, an immediate sale of government inventories can prevent inflated prices and preserve balanced market conditions. In cases in which the surpluses are large in relation to annual production, the disposition can be scheduled over a period of years. Generally, however, it will be best to clear the surpluses as quickly as orderly sale can be accomplished rather than to leave them as a continuing threat overhanging the market. Most industries can, and should, take the disposal process in their stride without special dispensations from the government. In this connection, it should be noted that the tax provisions for carry-back of losses and excess profit credits after the war greatly increase the possibilities for speedy disposal of surpluses without serious injury to producers.

There will be some industries, however, in which the postwar surplus is so large that it would practically saturate the market for years to come. The problem of these industries is further complicated by their wartime expansion of capacity many fold in excess of peacetime requirements. These lines of production are, moreover, crucial for our national defense. Aircraft and shipbuilding are cases in point. Each of these situations calls for careful study and discussion by all concerned to devise means to keep alive the necessary production organizations, the research effort, and the spirit of enterprise. Insofar as possible, the individual manufacturers should work out their own salvation in the conversion to peacetime markets. They can do this by taking on new lines, by increasing their production efficiency, and by developing technical improvements which make the existing inventories obsolete. But they still will need some kind of government protection or assistance while the huge surpluses are being worked off. It is most important, however, that such protection or subsidy be limited to a period of three to five years. It must not become permanent unless it is really essential for our national security.

The disposal of surplus inventories is part of the whole process of demobilization of the war effort and conversion to peace. If this process is to be accomplished with minimum dislocation and injury to our economy, it will have to be directed by a central agency which has developed adequate information service and is in position to coordinate the policies of the Armed Services and the other interested executive branches of the government. This agency should draw freely on the knowledge of businessmen in the specialized problems of marketing surpluses in each industry. It should formulate definite programs of inventory disposal for all industries in which the problem is acute; and it should make these programs public as soon as possible, so that business can plan for the future with confidence. In large measure, the success with which we make the economic transition to peace will depend on the quality of government administration in the process of industrial demobilization. We shall need better organization for the transition to peace than we had in mobilization for war if we are to avoid needless unemployment, loss of production, and frustration of business enterprise.



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ENGINEERING AND MINING JOURNAL

H. C. Parmelee, Editor

Scareheads Over Scarcities

DURING THIS WAR Americans seem to have realized suddenly a fundamental truth: that there are bottoms to national mineral barrels. As a result, whereas before the war we exploited resources with abandon as though they had no end, now certain spokesmen in the government, notably genial Bill Batt, are in a state of ferment because they believe they can see the end of our domestic mineral supply in the near future. Consequently, they are characterizing ours as a have-not nation, and are urging the acquisition of as much mineral raw material as possible through reverse lend-lease and postwar trade for both stockpiling and consumption after the war.

Whatever the merits of mineral importation may or may not be on other grounds, we believe that Mr. Batt is unduly alarmed over the state of depletion of our mineral resources. Admittedly the bulk of the richer mineral reserves have been extracted and the problem is one which should have the serious attention of government, but we are still the world's greatest mineral producer, and it cannot yet be authoritatively stated that any other nation or empire will exceed us in future production, either in terms of tonnage or self-sufficiency.

The problem of reserves is a tricky one to the uninitiated. Known reserves as of any particular date always turn out to be less than are actually mined, both because of discoveries and because improvements in technique make extraction more efficient. Thus, while it is bandied about freely today that we have about ten year's supply of high-grade iron ore, fifteen years of copper, five years of lead, and the same of zinc, at the present rates of production, we venture to predict that in none of these cases will the actual reserve prove to be less than double such figures, and may turn out to be much greater than that, even after allowing for the present extraordinary rates of production.

Mr. Batt's solution is to conserve our remaining mineral resources by depending more heavily on imports. Although we do not wish to be interpreted as opposed to imports in the final analysis, in throwing the conservation argument into the picture it should be kept in mind that no mineral resource is really conserved by crippling the domestic industry devoted to its extraction. Experience has shown that the truest conservation lies in sane utilization and the maintenance of a healthy industry, able to find new ways of cutting costs and treating the bulkier, low-grade reserves.

Also, in the domestic producer's behalf it should be pointed out that increments of price can work wonders, as demonstrated by the remarkable record of quicksilver, tungsten, chrome, vanadium, and other strategic mineral production during the war. It is well enough to state that higher prices to domestic producers mean higher cost to domestic consumers as a generality. Nevertheless, speaking for the raw-material producers, we see little weight in this argument unless the prices of raw materials are actually reflected in prices to ultimate consumers. It is difficult to trace, for example, the cost of the tin in a can of tomatoes at retail or that of zinc in a galvanized product. Also, in many cases where the raw materials are major components of the finished articles, the raw-material producer may well ask if he could not be paid a much higher price simply by squeezing some of the water out of manufacturers' profits and distribution costs.

In short, we see no necessity for panic or sudden changes in national policy based on the depletion of our mineral resources. We do believe that a national mineral policy should be the special concern of a group appointed from parties familiar with the mineral industry and conscious of their national obligation. It is time for a national mineral policy based on sound information and common sense. Neither the country nor the mineral industry can longer afford to have matters of mineral policy kicked around as a pawn in the great game of politics, incidental to crusades such as Morgenthau,

Ickes, Hull, and Biddle have undertaken in recent years.

A sound mineral policy will no doubt call for a greater dependence on imports than has been our wont in the past. It will just as certainly call for more encouragement to domestic production than has been government policy in peace time. Considering the probable expansion of our economy in the future, these objectives are not incompatible.

Baruch Plots a Postwar Course

In submitting the report on war and postwar adjustment policies, Bernard M. Baruch has lent the prestige of his business experience and ability to a second vital war document, the first being the rubber report. Having served in the first World War as chairman of the War Industries Board, and having once observed the halting and unorganized reconversion of industry from war to peace, none is better qualified than he to suggest policies and methods for achieving an orderly return to peacetime industrial activity. And when to his genius for analysis one adds his firm belief in private initiative and enterprise and his clear understanding of the relations between government and business, one can have faith in the fundamental soundness of his recommendations.

Although most of the report deals with the problems of manufacturing industries, because that is where the difficulties of reconversion loom large, it gives attention to raw-material industries, and lays down some basic tenets to govern postwar adjustments. Thus, the broad problem is to "create the atmosphere in which private initiative and resourcefulness—the traditional American spirit—can again take hold." Nor is Mr. Baruch frightened at the business outlook after the war. Unequivocally he affirms his belief that "there is no need for a postwar depression." Rather, he thinks that "our adjustment . . . should be an adventure in prosperity." And as one of the aids he recommends incentive taxes to encourage business growth and expansion.

Among the rules that the report recommends as a guide in the postwar disposal of surplus plants and property is one that will meet with the hearty approval of the mining industry—viz., "No government operation of surplus war plants in competition with private industry." This will hardly please the "yard-stick" boys who want to measure production costs in private industry by those obtainable under government operation; but Mr. Baruch probably was well aware of the fallacy of that procedure and sought to forestall it.

Of direct interest to mining is the recommendation that the proposed Surplus Property Policy Board develop, in cooperation with the WPB, a policy for stockpiling for war and postwar purposes. And in order to keep the war production program in balance, an early and periodic review is urged of the programs for production, stockpiling, imports, subsidies, and premiums. Clear distinction is drawn in favor of those strategic minerals that are not readily available to this country.

Implementation of the recommendations is up to Congress, and although that body will have its own plans for postwar adjustment, it can scarcely reject the sound proposals of the Baruch report. In principle it should be acceptable to Congress and business, and furnish a guide to peacetime pursuits.

Exploring Flotation Machine Fundamentals

Among the highly interesting papers presented in the flotation machine symposium arranged by the milling methods committee of the A.I.M.E. for the recent annual meeting of the Institute, was a thought-provoking discussion by E. H. Rose, mill superintendent of International Nickel Co., on "Flotation as a Power Process." To all those interested in the practical improvement of flotation machines, we recommend this paper as well as the papers prepared by Messrs. Banks, Myers, Falconer, and others.

Mr. Rose, after studying operating data he accumulated from several companies, came to the conclusion that a factor he calls "power intensity" is of great influence in the effectiveness of a flotation machine. He notes that those cells, covered by his data, having a high ratio of power input to cell volume also have a high ratio of capacity to cell volume. From this he concludes that relatively high power consumption in a flotation machine is not necessarily an undesirable characteristic.

Because certain of Mr. Rose's audience appeared to be extending this statement to mean that the more power put into a machine the better, we wish to add a word of caution. The fact is that simple increase of power input to the average flotation machine will accomplish nothing beyond boosting the power cost. If increased power does improve metallurgy, it can mean only that the cell was poorly designed to begin with. Most manufacturers have seen to it that their machines are designed for optimum performance with the particular impeller installed, and if more power is added, a corresponding change should be made in the machine itself, or the added power will be wasted.

The point is that it is not the quantity of power poured into a machine that counts; it is the manner in which the power is applied that is important. This was proved conclusively several years ago when an attempt

was made to improve an already successful flotation machine by adding certain baffles around the impeller and by constricting pulp passages in order to increase agitation and "pour the power to it," as the designer put it. Determined tests with this machine thereafter demonstrated that it had been improved only in its capacity for kilowatts. It used more power, but it floated no more mineral; and the design was abandoned.

Flotation is certainly, as Mr. Rose points out, a power process; but up to the present, designers have been applying that power with a fine abandon that overlooked the basic elements of what a flotation machine was required to do. The industry is still waiting for someone to analyze these elements and then design a machine in which power for these basic functions is applied efficiently and with maximum effectiveness.

Getting Acquainted With the Neighbors

IT IS POSSIBLE to live a lifetime in an apartment house in New York and never get to know the people who have the apartments on either side of you. Many New Yorkers actually prefer this isolation, but when it comes to borrowing a cup of sugar or getting someone to stay with the baby, they're up against it.

As a nation, the United States is beginning to realize that the un-neighborliness of its biggest city is a poor attitude to adopt internationally. Hence the formulation of the Good Neighbor policy, a program with whose economics you may disagree, but with whose aims it is difficult to quarrel. In order to get better acquainted with our Southern neighbors, for example, we have even invited some of them in to live with us for awhile and find out how we do things.

Under a system of "Inter-American Trade Scholarships," qualified young men of the twenty other Americas are selected, strictly on the basis of merit, to receive training in the United States in industries for which they have particular aptitudes. At present 80 men are now getting practical training in this country, five of them in mines and smelters of the West, and more are on the way. The companies to which they are assigned provide both instruction and living expenses, and the Inter-American Training Administration provides traveling expense and supervision. The whole program represents a part of the work of Nelson A. Rockefeller's Office of Inter-American Affairs.

During the two years each of these trainees spends in the United States, it is hoped that he will get not only increased proficiency in his chosen industry, but a healthy liking for the United States and its people as well. Industry is going to grow ever more rapidly in South and Central America in the future, and these young men now in training in the United States will quite likely play a leading part in that growth. When that time comes, the impressions the trainees have retained of the United States may greatly influence the course of Latin American industry. May their memories of their northern neighbor be pleasant ones!

Hats Off to the Industry

IT SEEMED REGRETTABLE, at the recent American Mining Congress-Colorado Mining Association meeting in Denver, that resentment against bureaucrats and regulation ran so high that shotgun blasts aimed at Washington hit not only ambitious politicians but many sincere and informed members of the industry, who are in Washington for patriotic reasons and are doing their best to handle the industry's affairs under very difficult conditions.

Nevertheless, in talking over their problems with operators on a subsequent swing westward, our salient impression quickly became one of wonder over the patience with which operators have borne the confused and often exasperating dicta of government and have still managed to accomplish a production miracle. Considering embarrassments of supply, shortages of manpower, the loss of experienced talent, indifference on the part of many individual workmen, and the pressure both on costs and patience exerted by the War Labor Board, it is impossible to understand without intimate contact how this miracle has been consummated.

As specific instances of phenomenal accomplishment, consider how an adequate or surplus supply has been provided of the strategic minerals, including quicksilver, tungsten, chrome, and vanadium. The same would have been true of manganese had it been necessary to draw heavily on domestic sources. Here is Utah Copper, moving 210,000 tons of material per day and milling 95,000 of it. The Tri-State district is handling ores containing an average of only 2.25 percent combined zinc and lead and tailings containing 0.75 percent zinc. Miami is treating 0.6 percent copper ore. All these are random examples of performances being achieved throughout the length and breadth of mining. Also, to the credit of mine labor, the no-strike pledge has been kept in the metal mines.

Our hats are off to the men who have done this job, including those in Washington who have done their part. All oratory aside, they have done the country a great service, which we hope will receive recognition.

THE SUNSHINE MINE is opened by five tunnels and three shafts. The electrolytic antimony plant here described treats the tetrahedrite concentrates produced by the company in its 1,100-ton mill

How Electrolytic Antimony Is Made at Sunshine Plant

W. CHURCH HOLMES, *Metallurgical Superintendent and Manager of Rare Metals Division, Sunshine Mining Co., Kellogg, Idaho.*

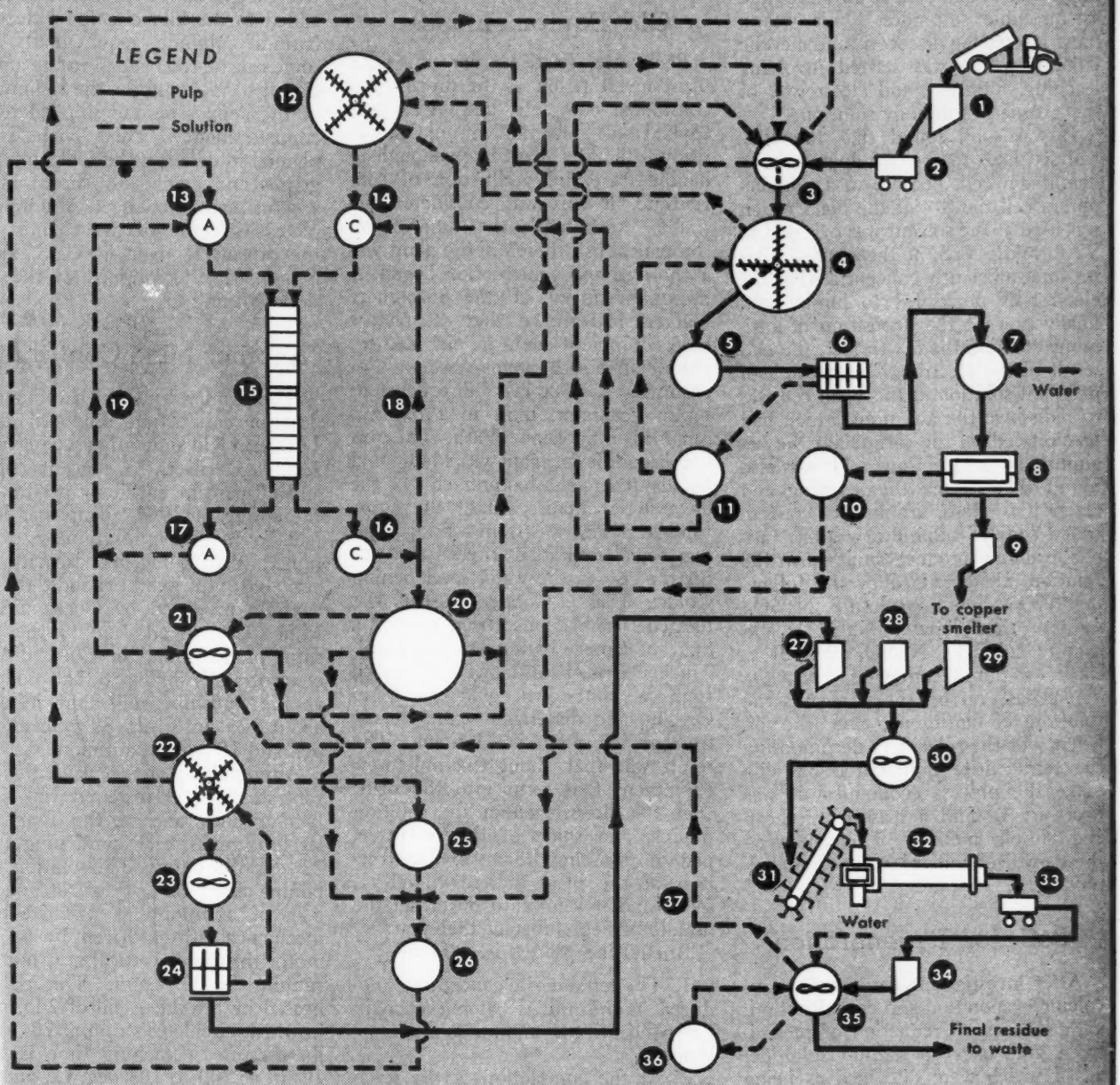
UNTIL THE discovery of lead-silver orebodies in 1943, the Sunshine mine, in Big Creek, Idaho, had been classed primarily as a silver property, although it had produced in the five years prior to Pearl Harbor, flotation concentrates containing between 1,050 and 1,100 tons of antimony per year (a quantity sufficient to class the mine as a major source of domestic antimony), and about 1,300 tons per year of copper. The valuable mineral of the Sunshine ore, and the source of all its metallic value, is an argentiferous tetrahedrite, a silver-copper-antimony sulphide which cannot be broken down physically and separated. Pyrite is the other principal sulphide, present in the ore in varying amounts, together with a small quantity of arsenopyrite.

The tetrahedrite occurs reasonably free, and about 85 percent of it can be floated into a high-grade concentrate after a relatively coarse grind. The rest is intergrown with pyrite in varying degrees from a rather coarse middling down to inclusions of tetrahedrite only a few microns in diameter. Fine inclusions, which are, of course, impractical to grind out, account at present for about 4 to 5 percent of the total tetrahedrite in the ore.

Mill metallurgy in the past had been concerned chiefly with maintaining the optimum grade of concentrate with regard to its smelter value. A bulk concentrate was made that included all of the coarser middling material and as much of the pyrite, containing the fine tetrahedrite intergrowths, as possible without lowering the grade below the calculated economic minimum. This method of operating the flotation units proved satisfactory, and the grade of the intergrown pyrite finally rejected into the tails was too low for profitable recovery.

Because of the copper values contained, it was desirable to have the concentrate treated in a copper smelter, but the high antimony content made the product unacceptable in large quantities in such plants. It was therefore shipped to a lead smelter, where the high antimony and copper content, together with a small amount of bismuth, introduced difficulties in handling that were reflected in the treatment schedule. Detailed study of the problem was started in 1937, and during the following five years various plans and processes were investigated in Sunshine's laboratory.

FLOWSHEET
SUNSHINE ELECTROLYTIC ANTIMONY PLANT



LEGEND

1. Bin, 50-ton
2. Mine car
3. Four leaching tanks 10½ x 10-ft.
4. Thickener, 20 x 8-ft.
5. Agitator, 7 x 6-ft.
6. Disc filter, 4-leaf, 6-ft.
7. Two repulpers, 7 x 6-ft.
8. Drum filter, 8 x 8-ft.
9. Storage bin
10. Residue wash tank, 10 x 10-ft.
11. Surge tank, 10 x 10-ft.
12. Pregnant solution storage tank, 16 x 10-ft.
13. Two catholyte storage tanks, 10 x 8-ft.
14. Two anolyte storage tanks, 10 x 8-ft.
15. Eight banks of 12 electrolytic cells each, arranged in cascades of 6 cells
16. Two catholyte storage tanks, 10 x 8-ft.
17. Two anolyte storage tanks, 10 x 8-ft.
18. Catholyte recirculated until it contains only 10 g.p.l. antimony
19. Anolyte recirculated until it contains only 175 g.p.l. NaOH.
20. Barren catholyte storage tank, 16 x 10-ft.
21. Three purification tanks, 10½ x 10-ft.
22. Thickener, 16 x 8-ft.
23. Two agitators, 7 x 6-ft.
24. Disc filter, 2-leaf, 6-ft.
25. Two caustic make-up tanks, 7 x 7-ft.
26. Purified anolyte storage tank, 10 x 10-ft.
27. Salt residue storage bin
28. Barite storage
29. Coal storage
30. Agitator, 6½ x 3-ft.
31. Bucket elevator
32. Rotary kiln, 6 x 28-ft.
33. Mine car, 1-ton
34. Black ash storage bin, 40-ton
35. Two agitators, 8 x 8-ft.
36. Two wash tanks, 8 x 8-ft.
37. Barium sulphate solution containing 250-300 g.p.l.

In the late spring of 1939 it was found that under proper conditions of temperature and concentration the argentiferous tetrahedrite was decomposed by an alkaline sulphide solution, dissolving the antimony and leaving the silver and copper in the residue as insoluble sulphides. This was a most interesting discovery, and a cyclic laboratory test was started involving leaching, filtration, and electrolysis of the pregnant antimony solution.

It was soon found that the electrolysis had to be conducted in a diaphragm cell, because in a non-diaphram cell the S^{--} of the Na_2S which was used as the solvent was oxidized to S^{-}, forming Na_2S_2 at the anode. This became sufficiently concentrated as the electrolysis proceeded to inhibit and finally prevent the deposition of antimony at the cathode. In fact, the end result of the electrolysis of a batch of pregnant solution in this open cell was to redissolve the antimony which had precipitated on the cathode at the beginning of the electrolysis. It was also found that during the leaching and electrolysis steps, using this concentrated sodium sulphide solution, various oxidation products built up in the solution, characterized by the following types: Sodium sulphite, Na_2SO_3; sodium thiosulphate, $Na_2S_2O_3$; and sodium sulphate, Na_2SO_4; as well as some sodium carbonate, Na_2CO_3. These have no benefit as regards the solution of antimony, and the efficiency of the solvent in decomposing the tetrahedrite rapidly fell off. To make the process economical it was necessary to find a reasonably cheap and simple method of regenerating these oxidized salts back to sodium sulphide.

BaS for Regeneration

After investigating various plans involving evaporation and crystallization, with subsequent reduction of precipitated salts back to sodium sulphide, all of which were discarded as being too expensive and too complicated for plant operation, a solution of barium sulphide was found to be a satisfactory regenerating agent. It worked well, and not only regenerated the oxidized sodium salts back to sodium sulphide but also gave a precipitated barium-sulphur-oxygen salt (except in the case of sodium carbonate) that could be reduced back to barium sulphide for re-use in the regenerating circuit.

During the rest of 1939 and the first part of 1940, the process was developed and checked by cyclic tests of several months' duration on a laboratory scale, making about 4 lb. of metallic antimony a day. This work was followed by building a pilot plant with a capacity of 1,000 lb. of antimony per day, which was placed in operation in December 1940. The plant operated during all of 1941 and the spring of 1942.

Old Equipment Used

Soon after Pearl Harbor, the pilot plant investigation of the process was considered complete, and WPB was advised that Sunshine Mining Co. was ready to build a plant large enough to handle its entire production of concentrate, if this was considered desirable. Antimony at that time was on the critical list; therefore the plant was authorized and construction begun. A thorough survey of the machinery markets had shown that satisfactory used equipment could be obtained for almost all critical items needed. For example, a 500-kw. direct-current motor generator, built in 1902, was obtained in Spokane, Wash. The unit had been idle for many years but could be adapted to the requirements of the electrolytic circuit. All of the structural steel used was from a bridge that had been dismantled to clear the way for the rise in the water level behind Coulee Dam. Copper busbar was located that had once been used in a Spokane storage battery standby plant. Thickener mechanisms were recovered from a shut-down gold mine in Oregon, and diaphragm pumps came from an idle plant in Montana. The result was that about the only new equipment that went into the plant were the filters, vacuum and solution pumps, and some of the mild-steel plate for building the tanks. Construction of the plant started March 1, 1942, and it went into operation the middle of September of that year.

Briefly, the process is as follows:

1. The tetrahedrite concentrate produced in the mill is batch-leached in hot concentrated sodium sulphide solution.

2. At the completion of the leach cycle, the pregnant solution is separated by settling and decantation. The residue is recovered by a double filtration with a repulping step between each stage.

3. The pregnant solution is electrolyzed in batches in banks of diaphragm cells, recovering the antimony on mild-steel cathodes.

4. The fouled solutions from the cell bank, both catholyte and anolyte, go to the regeneration circuit for treatment with the required amount of barium sulphide (BaS) solution.

5. After separation from the precipitated barium salts, the solutions are ready for re-use in the leaching circuit.

6. The precipitated salts from step 5 are mixed with coal and passed through a rotary kiln for reduction to a black ash containing barium sulphide.

The process is cyclic and regenerative except that some barite must be added to the kiln circuit to meet the barium sulphide requirements, and some caustic soda added to the anolyte circuit to make up for the sodium lost in the copper residue shipped to the copper smelter. Each phase is explained in detail in the following paragraphs and graphically shown in the accompanying flowsheet. A more complete discussion of the chemistry of the process is given in U. S. Patent No. 2,331,395, assigned to the Sunshine Mining Co.

Another Mine Contributes

The plant was designed to handle a flotation concentrate produced in the 1,200-ton Sunshine mill assaying about 1,500 oz. silver, 25 percent copper, and 20 percent antimony per ton. In the spring of 1943, manpower losses had so reduced the tonnage of ore mined that sufficient capacity was available in the plant to handle the concentrate produced by Coeur d'Alene Mines Co., in addition to the Sunshine production. The Coeur d'Alene concentrate is similar to that produced at the Sunshine mill, but it assays about 325 oz. silver, 30 percent copper, and 18 percent antimony.

After arriving at the plant, the concentrates are transferred in 5-ton batches into one of the four steel leaching tanks, each containing about 22 tons of solution. The solution, containing about 250 g./l. of Na_2S and 10 g./l. of antimony, is agitated by a mechanical stirrer driven by a 5-hp. motor through a vertical gear box and running at 17 r.p.m. The pulp is heated by a welded coil of 2-in. pipe, in which circulates steam at 20- to 25-lb. pressure. Leaching time is 8 to 10 hr. at 100 to 103 deg. C., and the concentrates are charged when the solution reaches a temperature of 95 deg. C. The sides and tops of the tanks are covered with wood for heat insulation, and the evaporated vapor is exhausted out of the building by a fan.

At the end of the leaching period, evaporation loss is made up by addition of wash water recovered from filtering the residues. Roughly, two tons of water are evaporated during a normal leaching cycle. The leached pulp is pumped to a 20x8-ft. thickener by standard 2-in. centrifugal pumps. Thickener rakes are operated only when withdrawing the settled residue,

which is handled by a duplex diaphragm pump. There is no overflow from the thickener, the clear pregnant solution being decanted from time to time by gravity into the bowl of a vertical packless pump discharging into the pregnant-solution storage tank. This unit is equipped with a thickener mechanism, and every few weeks the rakes are started and any slimes which have collected in the tank are returned to the residue thickener.

Double Filtration Follows

No heat is applied to the residue thickener, and it is not covered, because some cooling of the solution aids in settling the very fine slime produced by the severe leaching conditions. Thickened residue is drawn off from time to time by the diaphragm pump and is handled as shown in the flowsheet. Filter cake from the leaf filter is washed by water to one or the other of the repulp tanks, where the solution is diluted to a strength of 90 to 100 g./l. of Na_2S. When one of the repulp tanks is full, the filter cake is directed into the other tank, and the final filtration started on the batch in the full tank. In this case, a drum filter is used, and the cake washed with hot-water sprays. The wash water, carrying about 70 to 80 g./l. of Na_2S, is used in diluting the leach pulp down to its original content of 250 g./l. of Na_2S.

The residue is difficult to filter, and contains slightly more than 20 percent moisture. Canvas filter cloths are used, and they have a life of from 15 to 20 days. A much clearer solution can be obtained by settling than by filtration, so the filtrate from the disk filter handling pregnant solution is received in a cone-bottom tank. A clear, pregnant solution can be decanted from this tank from time to time, and the cloudy settled portion is returned by gravity to the residue thickener.

The main electrolytic section of the plant consists of 96 cells connected in series. They are arranged in cascades of six, there being 8 banks of 12 cells. For purposes of feeding solution, the electrolytic section is separated into two banks, each bank being fed from its individual anolyte and catholyte tank. The cells are 30 in. deep, 32 in. wide, and 60 in. long, and contain 8 anodes and 9 cathodes, spaced on 2½-in. centers. The cathodes and anodes are made from mild steel, the former being $\frac{3}{16}$ in. thick and the latter about $\frac{1}{8}$ in. Each anode is incased in an individual, fabricated mild-steel frame with sides of heavy canvas sail cloth. Partitions in the frame direct the flow of the anolyte solution across the face of the anodes, and all frames in a cascade are connected in series with rubber hoses.

The anolyte and the catholyte are stored in tanks set above the top of the cell cascades, and the solutions are fed into the cell banks by gravity, the rate of flow being regulated by grease-lubricated plug valves. Both the anolyte and catholyte are electrolyzed in batches. During the electrolysis, part of the sulphur of the catholyte migrates to and concentrates in the anolyte, while part of the sodium of the anolyte migrates to and concentrates in the catholyte. Briefly, the cell reactions, or rather their end effects, are:

1. The antimony deposits on the cathodes.

2. Sulphur concentrates in the anolyte, forming among other compounds sodium polysulphide, Na_2S_3; sodium sulphite, Na_2SO_3; sodium thiosulphite, $Na_2S_2O_3$, and sodium sulphate, Na_2SO_4.

3. The alkalinity of the anolyte decreases, but that of the catholyte increases.

Fresh anolyte is made up of a mixture of a solution of caustic soda (NaOH) and barren catholyte, and it has an alkalinity equivalent to 225 g./l. of caustic soda. It is discharged into the anolyte feed tanks in 7½-ton batches, and an equivalent volume, having an alkalinity of about 175 g./l., is withdrawn and sent to the regeneration section.

The fresh catholyte, also handled in batches, carries about 50 g./l. of antimony and has an alkalinity equivalent to 250 g./l. of NaOH. The barren solution withdrawn from the circuit carries between 8 and 10 g./l. of antimony and has an alkalinity equivalent to about 280 g./l.

Catholyte is introduced near the bottom of each cell, and is withdrawn from the top. Because the depletion of the antimony in the solution lowers its specific gravity, the weakest solution in the cell is therefore always drawn off and fed to the following one in the cascade. The solution coming off the end cell in the cascade is pumped back to the catholyte feed tank unless its antimony content is down to 8 to 10 g./l., in which case it is diverted to the barren-solution storage tank. About 30 tons of barren solution is withdrawn during one cycle, and a like amount of fresh pregnant solution is added to the feed tank.

Cathode and Anode

The cathodes have a submerged area of 3.33 sq.ft. per side, and the total cathode area per cell is 53.3 sq.ft. The anodes are slightly smaller in cross-section in order to lessen the growth of trees at the edges of the cathode plates. Current carried on the busbars is 1,500 amp., which gives a current density of 28 amp. per sq.ft. There is no gassing at the cathodes until the antimony content of the solution drops below 8 g./l. Voltage drop varies slowly between 2.5 and 3 volts per cell, depending on the alkalinity of the anolyte, and averages about 2.65 volts per cell. The cathodes are stripped on a three-day cycle. Direct current is furnished to the busbars by two generators connected to a 700-hp. synchronous motor. Each generator is capable of delivering 750 amp. at 300 volts full load. The two units are connected in parallel and thus furnish 1,500 amp. to the cell circuit at 300 volts.

Metal to Storage

After stripping, the granular metal is washed by percolation in hot water to remove adhering solution, and then transported by cars to a 100-ton storage bin. Handling the extremely caustic and high-sulphide sulphur electrolyte presents a number of difficulties, one of which is the necessity of keeping the solutions above 40 deg. C. at all times, so as to prevent contained salts from crystallizing out. This requires that all pumps and pipe lines in intermittent service be drained and hydraulicked with water to dilute any solution left in them. After thawing out a few lines in the early weeks of operation, the crew is careful about this, and little difficulty is now experienced from "frozen" pipe lines.

The character of the solution and its susceptibility to oxidation present a much more serious problem. This oxidation occurs for the most part in the anolyte section of the cell circuit, but the action during the leach also decomposes the solvent. These oxidized salts must be regenerated to sodium sulphide or the solvent would, after a few cycles, need to be replaced by fresh sodium sulphide solution. Of course, this would be far too expensive, so we feel that the regeneration stage of the process is the one that makes it commercially practicable. All of the fouled anolyte and part of the catholyte are regenerated by addition of a hot barium sulphide (BaS) solution containing between 250 and 300 g./l. of BaS. The barium sulphide precipitates the oxidized salts and regenerates their sodium component back to sodium sulphide.

The solution to be regenerated is heated in one of three steel tanks by steam coils and agitated by a Deveraux agitator. When the solution reaches a temperature of about 95 deg. C.,

hot barium sulphide solution is added in slight excess over the amount required to regenerate the solution completely. Next, enough fouled solution is run into the tank to leave it with a slight deficiency of barium sulphide, because an excess of the latter is undesirable. After regeneration, the solution is pumped to a thickener to allow the precipitated salts to settle.

The salts settle quite readily, and a clear solution is decanted by gravity; part of it to be mixed with barren solution from the cell bank to form fresh anolyte to be re-added to the cells, and part of it returning to the leach circuit, where it is mixed with unregenerated barren catholyte. Some of the regenerated anolyte is too low in alkalinity for direct addition to the leach circuit, and if this is the case its alkalinity is increased by adding fused caustic soda.

The precipitated salts are drawn from the bottom of the salt thickener by a diaphragm pump discharging into two storage agitator tanks connected in closed circuit with a two-leaf disk filter, the filter overflow returning by gravity to the thickener. The filtered salts are now mixed with about 20 percent powdered coal and charged into a small agitator. Finely crushed barite may or may not be mixed into this charge, depending on the amount of salts on hand. In other words, when the stock of regeneration salts is low, barite is mixed with them to make up the kiln feed; and when they are adequate, no barite is added to the charge. A small amount of water is added to the mixture in the tank in order to produce a thick slurry, which is fed into the kiln.

The rotary kiln is lined with firebrick, and is oil-fired. It makes about one revolution in 1 min. 20 sec., and the temperature at the discharge end is about 900 deg. C. The black ash discharged at the firing end falls into a 1-ton end-dump car, which is subsequently trammed to a cage and elevated to the black-ash storage bin installed above the two agitators. The bin is brick-lined inside the steel shell. Cooled black ash is leached in either of the two agitators below the bin, the residue being washed by decantation and finally discarded without filtering.

The leaching cycle is to fill one of the tanks with the first wash solution from a previous leach and draw sufficient black ash from the bin to make a solution carrying 250 to 300 g./l. of barium sulphide. When this point is reached the agitation is stopped and the residue allowed to settle. The pregnant solution is decanted and pumped to one of the regeneration tanks, where it is immediately used. Residue in the tank is then repulped with the second wash from a preceding leach. After settling and decantation, the repulping operation is repeated in hot water. Following decantation of this second wash, which will carry about 30 g./l. of barium sulphide, the resulting residue is sent to waste. The regeneration circuit requires the addition of barite from time to time, due in part to the lack of perfect reduction in the kiln and in part to the precipitation of barium carbonate, which, of course, carries barium out of the circuit.

The metal produced is sold to the consumer market as unrefined granular cathode antimony, and contains 96 to 97 percent antimony and 2 to 3 percent arsenic. The total of copper, lead, iron, bismuth, and other elements is less than 0.4 percent, and the remainder is a small amount of unwashed-out solvent, which probably oxidizes to sodium sulphate. The mechanics and economics of fire refining the cathode metal have been studied, and, though the process is perfectly feasible, it is desirable, at least for the present, for Sunshine Mining Co. to market its antimony in the unrefined cathode form.

In conclusion, I acknowledge gratefully the work of the research and operating personnel, whose ideas made the successful construction and operation of the plant possible, and the contributions of R. D. Leisk, general manager, and Wayne D. Gould, assistant metallurgical superintendent, who is now in charge of plant operations.

Propane by Long Haul Useful to Basic Magnesium

PROPANE GAS used by Basic Magnesium, Inc., at its plant near Las Vegas, Nev., is hauled to the plant from the Richfield absorption plant situated about 27 miles southwest of Bakersfield, Calif. This gas is transported on 35-ft. semi-trailers on which have been mounted four 96-in. O.D. spherical tanks constructed of ½-in. flange steel having a 250-lb. A.P.I.-A.S.M.E. code working pressure. All welding in these tanks was X-rayed. The tanks have a net capacity of 1,735 gal. each and weigh 6,300 lb. empty. The advantage gained by the special design of the spherical tanks is that the tare weight of the vehicle is cut considerably, permitting maximum cargo capacity. It likewise saves approximately 40 percent of the steel which would be required in the conventional cylindrical tank.

A round trip covering approximately 640 miles is completed in 24 hours. In summer, these trucks must be so timed as to travel the desert at night.

The gas is discharged into Basic Magnesium's storage tanks. There are eight of these, each holding 20,000 gal., which is approximately nine days' supply. One of the tanks is situated at Camp Anderson, operated by Basic for housing some of its employees. At this camp, propane gas is used for every domestic purpose: cooking, heating, and refrigeration.

The remaining seven tanks supply the needs of the magnesium plant itself. The liquid propane is converted into a vapor and mixed with air to give a gas with a heating value of approximately 1,600 B.t.u. per cubic foot. This is accomplished with six Gasair units. These are completely self-contained, requiring no outside source of power or energy for their operation. Each unit is capable of vaporizing approximately 180 gal. of propane per hour and mixing this vapor to give 1,600 B.t.u. fuel value at the rate of 10,000 cu.ft. per hour. This mixed fuel is delivered to the magnesium refinery at a pressure of 5 psi., where it is used for heating the large refining furnaces. In addition, the fuel is used for heating the molds in the automatic casting machines, as well as for many other minor uses.

Through installation of this equipment, Basic Magnesium has all the advantages of operation with natural gas, with its cleanliness and ease of handling. In addition to this, the company has complete control of its own utility.

Horizontal Auger Drill Useful In Mesabi Open Pit

It offers definite advantages for certain kinds of ores and operating conditions

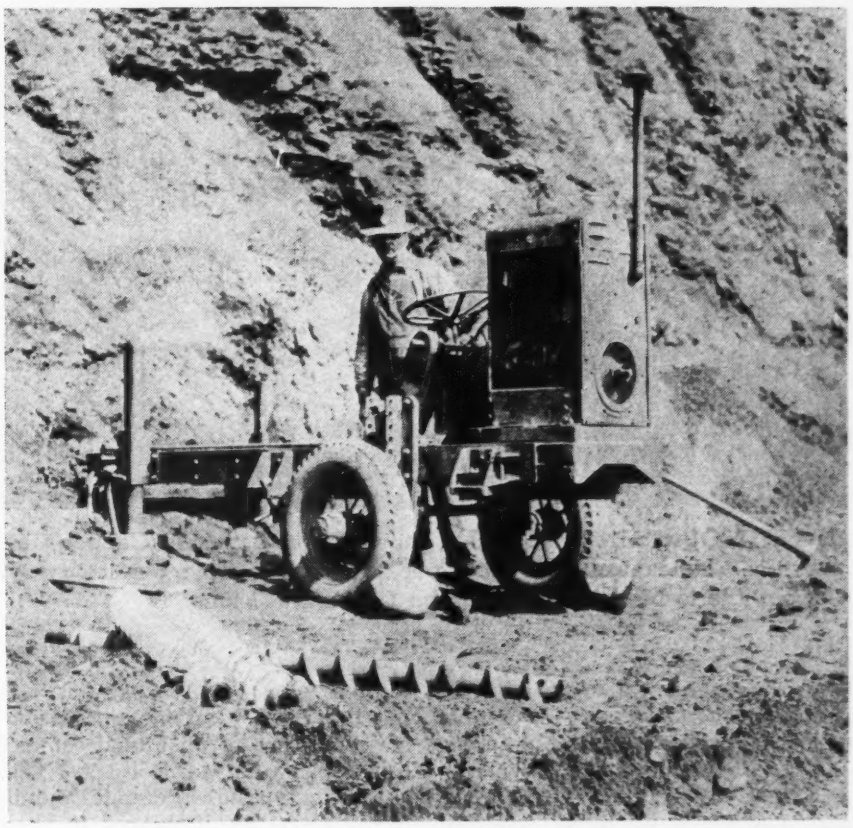
SIXTY PERCENT of the 1,600,000 tons of crude iron ore mined by Evergreen Mines Co., of Crosby, Minn., at its Argonne mine, on the Mesabi Range, in the last three years has been drilled with a horizontal auger drill using a cutting head 6½ in. in diameter, according to Arne Tuomala, superintendent of the mine, who sends the data here presented. The particular machine employed is the Parmanco drill, made by the Paris Manufacturing Co., of Paris, Ill.

The drill at the Argonne was one of the first large-size horizontal auger drills used on the Mesabi. It is driven by an air-cooled Wisconsin gasoline engine, and is mounted on two standard 6:00 x 16 pneumatic-tired wheels which have separate clutches and are powered by the Wisconsin engine for moving. The front or steering wheel is of the pedestal type and has a full swing, allowing complete maneuverability.

A Screw-type Bit

This machine drives a screw-type auger bit made in 6-ft. sections which are manually assembled or disassembled by means of a light tool or tong. The cutting bit is a claw-type head with inserted teeth, which are wedged in place and easily changed. The auger-type flights are 6 in. in diameter. The cutting head is designed to cut a hole 6½ in. in diameter, as already stated, to allow for tooth wear and irregularities.

Proposal has been made to substitute 4-in. flights with a corresponding head so that the drill may be used in flat-lying formations with narrower seams of softer material. Experimentation has been conducted with a variation of a fish-type bit for use in material whose hardness prevents use of the claw-type drilling bit. As yet, none has proved practical for general use. The drill head is advanced by a hand mechanism, fitted with a two-speed selection for drilling in various conditions—high speed being used for drilling in soft and dry short holes; slower speed where the formation is hard or binding in longer holes (over 25 ft.)



DRILLING a horizontal hole with a Parmanco drill in one of Butler Brothers' open pits on the Mesabi Range. This type of drill is finding increasing application in the Iron Country

Use of this drill is limited to drilling of standard Mesabi wash ores, tight-direct-shipping ores, which require heaving rather than shattering, and it has been used successfully in drilling in the Mesabi paint-rock layer. By selecting a sand seam below a heavy, hardpan or frost layer, it may be used to considerable advantage in surface drilling. (In sinking cuts or where blocky, hard-rock material is met, a vertical-type churn drill like the Bucyrus-Erie 27-T is used.)

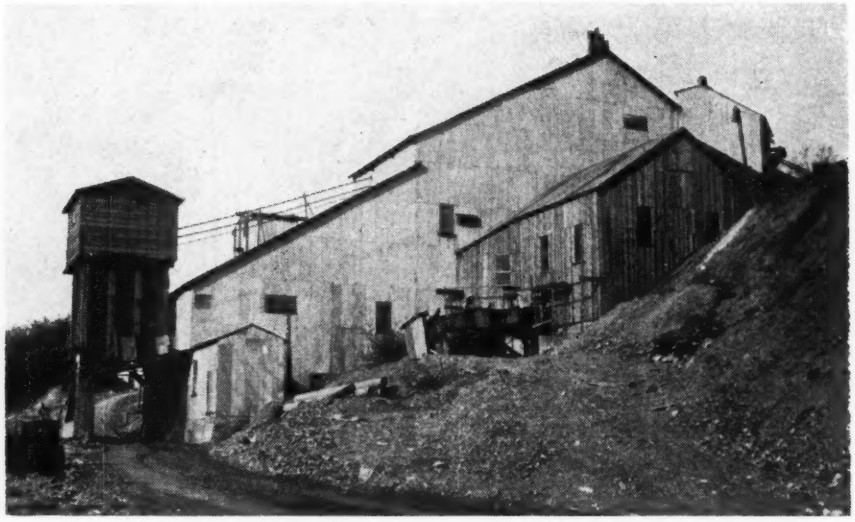
The powder is tamped with soft dirt in 5 x 16-in. paper sacks which are placed with long tamping poles.

A drill crew consists of two men—the driller being in charge of operation of the drill, directing the work, and the helper, who assists in assembling and disassembling drill flights, cleaning up cuttings from the hole and leveling the ground prior to drilling. This crew can consistently drive 180 to 200 ft. of 6-in. horizontal holes per 8-hour shift, when working in standard Mesabi wash-ore material.

In general, the horizontal drill holes of 30 to 35 ft. in depth are most successful and are considered more desirable both as to drilling efficiency and blasting efficiency. A horizontal hole is considered more favorable for blasting, inasmuch as all of the powder is under the burden, spreading the blast along the bottom of the bank, eliminating islands between holes, and tending to lift the burden rather than spray it, as will happen in the case of heavily loaded vertical holes.

Neglected Copper-Zinc Belt Revived Under War Demand

JOHN B. HUTTL, *Associate Editor*



IN THE MOUNTAIN KING MILL, shown here, Keystone Copper Corporation is concentrating 300 tons per day from its mine, 6 miles away. Capacity is to be raised to between 500 and 600 tons

WAR DEMAND for strategic minerals, particularly copper and zinc, has brought a substantial revival of mining in the historic copper-zinc belt which traverses the eastern section of Calaveras County, in California, separated from the Mother Lode gold belt by the Bear Mountain range. Copper mining is not new here. In fact, the metal was mined as early as 1860, and up until the development of the large deposits in Shasta County in 1896 the belt furnished most of California's copper output. The principal producers were the Union and Keystone mines of the Calaveras Copper Co., at Copperopolis, and the holdings of the Penn Mining Co., near Campo Seco, 30 miles northwest. Both had large modern reduction plants. Work stopped in 1930 and 1920 respectively, due to low prices. Other former producers visited are the Nassau, Napoleon, Constitution, Collier, and Quail Hill. Of these the Nassau and Constitution are idle.

Not until just before Pearl Harbor did the old mines again attract attention. Entrance of the United States into the war led to the reopening and rehabilitation of the Keystone, Penn, Quail Hill, and Collier mines. A substantial tonnage of copper was produced in 1943. Most properties are operated under a premium and contract agreement with Metals Reserve Co., and the output of concentrates and direct smelting ore is shipped to Utah smelters.

To encourage mining the U. S. Geological Survey started geological studies in 1943, and investigated individual mines. A drilling program, moreover, is being carried on by the U. S. Bureau of Mines in cooperation with the Survey in the hope of disclosing new ore that can be mined quickly. The work has played a part in the steadily increasing production since the latter part of 1943.

The Keystone Mine

Since it was reopened, the Keystone has developed into California's second largest copper producer. The property lies in the same mineralized zone as the company's other holdings, the ore occurring in lenticular bodies. Some outcroppings were worked as early as 1860. Before the shutdown in 1930 the company operated a 500-ton flotation mill and a smelter containing a D.&L. sintering machine, a 250-ton blast furnace, a reverberatory and converters. The reduction works were subsequently dismantled and the mines allowed to fill. Early in December, 1941, H. E. Bush acquired a lease and interested Stewart & Nuss, Fresno contractors. Unwatering was begun and continued until the deepest level, the 675, was accessible. Here, good ore on which the former operators had drifted on 12 ft. each way on the vein was found. After thorough examination, it was decided to start development on the three lower levels. The Mountain King mill, 6 miles away, was then leased and the first concentrates were shipped Oct. 13, 1942. On July 1, following, the Lava Cap Gold Mining Corp. acquired a managing interest, and operations have since been carried on under the name of Keystone Copper Corp.

The mine is developed by a three-compartment shaft and the levels mentioned. Sinking started in July 1943, and the shaft is now 1,115 ft. deep, with two new levels, the 7th and 8th, established at 875 ft. and 1,075 ft. Drifting and crosscutting on the 7th level has opened one of the known oreshoots for 200 ft. along the strike. No lateral work has as yet been done on the 8th level. The vein under exploitation strikes northwest, dips 62 deg. NE., and is about 40 ft. wide. The footwall is composed of green feldspathic schist, and the hanging-wall rock is known locally as greenstone, a spotted schist derived from andesitic and dacitic volcanics. The vein proper is a belt of black slate intruded by a granodiorite dike. Ore occurs entirely within the slate, with chalcopyrite as the only copper mineral, all vein material being highly impregnated with iron pyrite. It is generally believed that the chalcopyrite came in later and replaced the iron. All important orebodies are found in the areas subjected to most fracturing. At present four shoots are being mined in a 600-ft. length along the strike.

Currently about 75 percent of the ore is coming from workings between the 525 and 675 levels. This will change in favor of the lower levels once

development is finished. Daily mine output is now 300 tons, most of this coming from development. Mill capacity, now about 450 tons per day, is to be raised to between 500 and 600 tons, to keep pace with the mine. Copper production in 1943 amounted to more than 4,000,000 lb. This is impressive when compared with the 38,000,000 lb. produced from 1902 to 1930 and with 890,000 tons taken out in the properties south of the Keystone. The ore now mined contains 2½ to 3½ percent copper, and 17 to 20 percent iron. No gold or silver is present.

Mining by Shrinkage

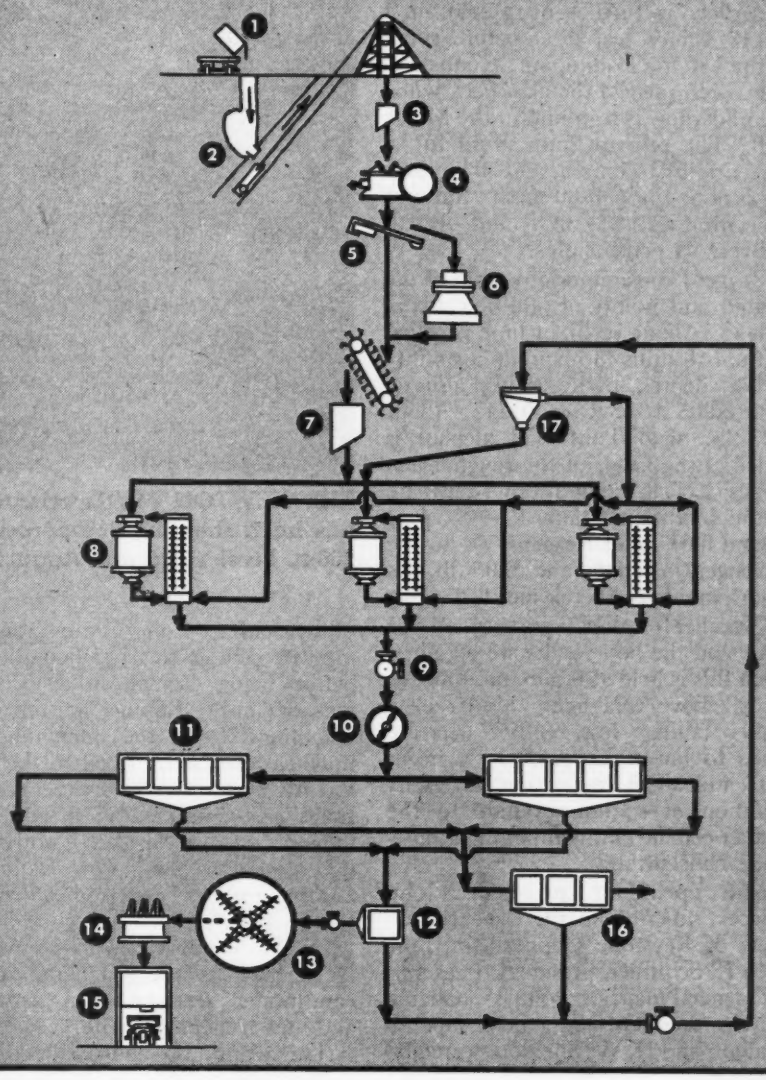
Underground, drifts and crosscuts are carried 6x7 ft. and mining is done by shrinkage stoping, using air drills and detachable bits. Ore is mucked into 30-cu.ft. rocker-bottom cars by Eimco and G-D mechanical loaders, hauled by a small battery locomotive. The shaft is timbered with 8x8-in. timber, and has an 85-ft. wooden headframe. Two 2-ton skips are hoisted by a double-drum Allis-Chalmers hoist driven by a 150-hp. motor. Mechanical ventilation is used, the mine air being exhausted through raises and an old shaft by a 22,000-cu.ft. Sturtevant fan. Working conditions have been improved since this was installed. Surface structures include a hoist house containing the hoist mentioned, also a reserve hoist, a 1,750-cu.ft. C-P compressor driven by a 125-hp. synchronous motor, and three portable G-D units (two 50-hp. and one 75-hp.); a change house; repair shops, a warehouse, and the office. Considerable equipment was brought here from the company's Central mine and mill, near Nevada City, which was shut down soon after WPB's gold-mine closing order was issued. Production is hauled to the mill in 20-ton trucks. Power is supplied by Pacific Gas & Electric Co.

Metallurgical changes at the mill have resulted in improved recovery and production of higher grade concentrates. The flowsheet follows, more or less, that used in modern flotation plants handling copper ores, as will be seen in the accompanying line cut. The 20-ton trucks dump the mine-run ore into a 160-ton underground pocket, whence it is hoisted in 2-ton skips to a 50-ton coarse-ore bin at the head of the mill. Primary crushing is done in a Wheeling jaw crusher adjusted to give a 3-in. product. This in turn is passed over a Symons screen with ½-in. openings, the oversize being reduced to minus ¾ in. in a 2-ft. 4-in. Traylor gyratory.

On the grinding floor, overflow from the ball-mill classifiers is pumped to a conditioner ahead of a Fagergren rougher machine consisting of four 44-in. cells and a second Fagergren unit of five 44-in. cells, between which the feed is divided. Concentrates are cleaned in a 56-in. Fagergren cell, and the tailings after passing through a level-type three-cell, 56-in. Fagergren scavenger machine flow by gravity to the pond.

Cleaner or final concentrates are pumped to a 30x10-ft. Dorr thickener, and the cleaner tailings and middlings from the scavenger machine go to a

MILL FLOWSHEET
KEYSTONE COPPER CORPORATION



LEGEND

1. 20-ton truck
2. 160-ton shaft pocket. Two-ton skip
3. 50-ton coarse-ore bin
4. 15x38-in. Wheeling jaw crusher, set to 3 in.
5. 3x6-ft. Symons rod-deck screen, ½-in. openings
6. 2 ft. 4 in. Traylor gyratory, crushing to ¾ in.
7. 350-ton fine-ore bin, supplied by elevator
8. Three ball mills: One 7x8-ft. Hendy, in closed circuit with 6x22-ft. Dorr classifier. One 5x5-ft. Marcy with 4x18-ft. classifier. One 7x6-ft. Allis-Chalmers mill with 6x22-ft. classifier
9. 4-in. centrifugal pump. One Wilfley, one Kimball-Krogh (one as stand-by)
10. 6x8-ft. conditioner
11. Two Fagergren flotation machines, one having four 44-in. cells, one with five
12. One 56-in. Fagergren cleaner cell
13. 30x10-ft. Dorr thickener fed by 2-in. Wilfley sand pump
14. 3x4-ft. Eimco leaf filter
15. 150-ton storage bin
16. Level-type 3-cell, 56-in. Fagergren scavenger machine
17. 6-ft. classifying cone

6-ft. classifying cone at the head of the Marcy mill. Wilfley 2-in. sand pumps are used for pumping the concentrates, middlings, and cleaner tailings to the respective treatment units. Thickener underflow is further dewatered in a 3x4-ft. Eimco leaf filter before going to the 150-ton loading bin. Cone overflow is returned to the classifiers, while the underflow is reground in the Marcy mill. The primary mills grind to 15 percent plus-165 mesh, and all regrinding is done through 80 mesh. Ratio of concentration is 14 to 1, and over-all recovery 94 percent plus.

Reagent consumption per ton of ore treated and points of addition are as follows: About 1¼ lb. of lime is added to the ball mills to maintain alkalinity and to depress pyrite. They also receive 0.005 lb. of Reagent 242. About 0.03 lb. of du Pont B23 alcohol is added at the heads of the rougher machines; 0.07 lb. sodium ethyl xanthate to the conditioner tank; 0.04 lb. pine oil and 0.03 lb. of Reagent 301 to the scavenger machine; and 0.05 lb. sodium cyanide to the cleaner cell.

Classifier overflows are titrated for CaO, and the best results are obtained when this is held at 0.2 lb. per ton. An excess above this figure results in a higher tailings loss, and a decrease tends to lower the grade of concentrate and affects extraction adversely. Addition of sodium cyanide to the cleaner cell aids in maintaining a high-grade concentrate.

Mill operations are under John Palecek, superintendent. Executive officers of Keystone Copper Corp. are Otto E. Schiffner, president, treasurer, and general manager; John W. Chandler, vice president and general superintendent; and H. W. Sheldon, secretary.

Re-treating Tailings

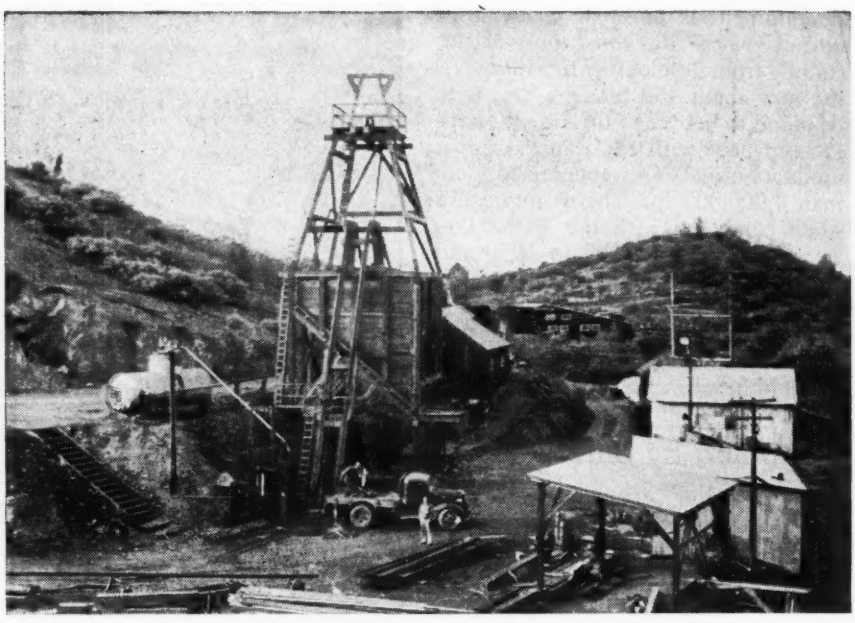
Also active at Copperopolis is the enterprise of the Pacific Mining Co., known as the Calaveras Copper Venture. This is a tailings-re-treatment operation. The company has leased an old dump situated near the Keystone property and below the dismantled Union mill, which is estimated to contain 600,000 tons, from which it is expected to recover about 5,000,000 lb. of copper. A 1,000-ton flotation plant has been completed, and tests were in progress at the time of my visit in December, 1943.

Tailings are hydraulicked from the dump with 2-in. hoses fitted with ⅞-in. nozzles. The pulp flows to a sump, and then is lifted by a 6-in. Dow sand pump to a 16x16-ft. agitator containing a 3-ft. blade revolving at 100 r.p.m. From here the pulp flows by gravity direct to an eight-cell Fagergren flotation machine. Concentrates from the first two cells go to a small conditioner before being cleaned in a three-cell Denver unit. Tailings go to waste. Middlings from the remaining six rougher cells are returned to the head rougher unit. Finished cleaner concentrates are dewatered in a 11½x14-ft. Oliver filter, and the cake is trucked to rail 23 miles away for shipment. Cleaner tailings are pumped back to the rougher.

Pine oil and amyl xanthate are added at the head of the rougher unit; the conditioner receives amyl xanthate, and lime to depress pyrite.

The plant also contains a regrind unit consisting of a 6x4-ft. Union Iron Works ball mill and a Dorr-type classifier to handle coarse sands from various sections of the dump and ores from outside sources. A shipment of concentrates was made recently, and regular production soon is expected.

P. R. Bradley, Jr., is general superintendent. Harry Bradley, superintendent, aided by L. C. Heckman, foreman, directs operations at the plant, where 15 men are currently employed.



THE NEWTON MINE, operated by Winston Copper Co., near Ione, has been shipping 9½ percent ore to a Utah smelter from above the 200-ft. level since last August

In the West Belt

In the mineralized area known as the west belt, six miles southwest of Copperopolis, are the Quail Hill, Collier, and Napoleon mines. The last has been inactive since July 1943, when Mountain Copper Co., Ltd., relinquished its lease.

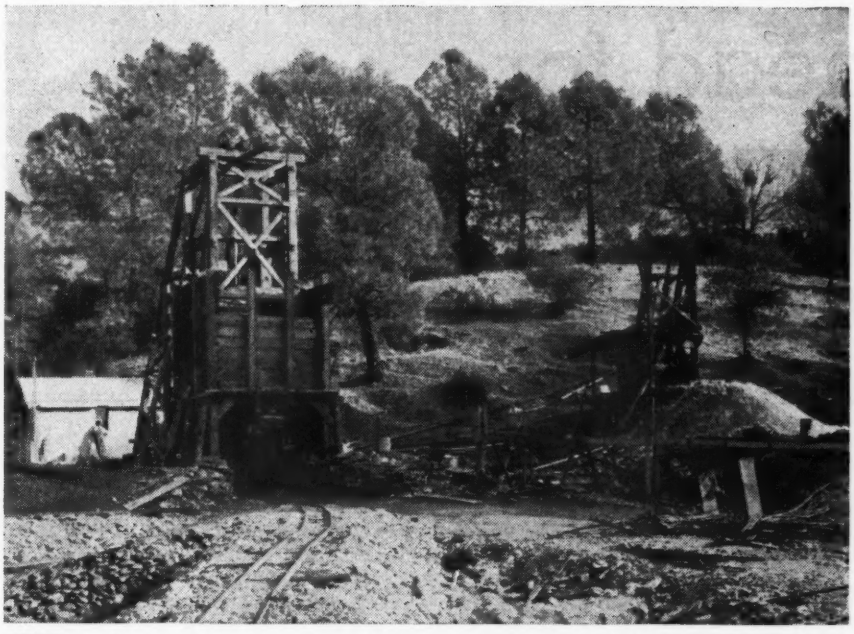
The Quail Hill and Collier mines have been active for more than a year as producers of copper and zinc ore. This ore is hauled by truck to Farmington, whence it is shipped by rail to the Salt Lake Valley, where it is milled and smelted. The two mines lie 3 miles apart, in a belt of intensely deformed volcanic rocks cut by intrusive masses of quartz porphyry and felsite.

The Quail Hill was originally opened during the sixties of the last century, and has been operated intermittently since. It has a vertical shaft 280 ft. deep, with active levels at 170, 205, and 270 ft. The ore is principally an intimate mixture of sphalerite, chalcopyrite, and pyrite, but also contains a little lead, gold, and silver, with barite as a gangue mineral. It occurs as irregular masses, formed by replacement of felsite and felsite breccia, and is developed in shear zones adjacent to the contact of an intrusive felsite body.

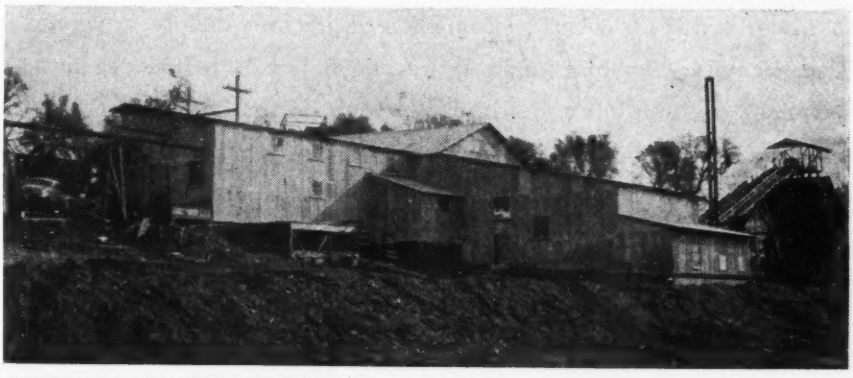
The Collier likewise was opened originally in the sixties, with intermittent operations since then. It consists of a steeply inclined shaft 140 ft. deep, with levels at 56 and 125 ft. It is in volcanic greenstones and bedded tuffs, close to the contact of an intrusive mass of quartz porphyry. The ore consists of chalcopyrite, sphalerite, and pyrite, with small amounts of gold and silver, and with barite as a gangue mineral. The ore zone follows and is possibly controlled by a fault that forms the footwall. In both mines some secondary chalcocite was present to depth of 60 ft. or more.

The Penn Mine

Near Campo Seco are the Constitution mine, idle as stated, and the Penn



ZINC is the prime objective of the operators of the Penn mine, near Campo Seco. Ore is to be milled at the Eagle Shawmut plant 65 miles away



TAILINGS RE-TREATMENT in a 1,000-ton plant, here seen, is under way in an enterprise known as the Calaveras Copper Venture, conducted by Pacific Mining Co. and to yield 5,000,000 lb. of copper

property. Work at the Penn at the time of my visit was centered in unwatering the workings served by No. 2 and No. 3 shafts. The mine is developed to a depth of more than 3,000 ft., shaft No. 2 being 1,100 ft. deep and No. 3 shaft 1,400 ft. An incline winze a short distance from the lowest station in shaft No. 3 affords access to levels below the 1,400-ft. horizon. There are 11 and 13 levels respectively in the No. 2 and No. 3 shaft areas which are about 1,200 ft. apart in a straight line. Unwatering involves removal of more than 30,000,000 gal. of highly acidic water. The property is operated under lease by Clemson and Miller, of Los Angeles, under the name of Eagle Shawmut mine, Penn Mine Division. The Penn Mining Co., the former operators, worked the property until 1920, treating the output in a 300-ton smelter equipped with two 150-ton reverberatories, a 100-ton blast furnace, eight McDougall roasters, and a converter. Some cement copper was made in a precipitation plant near shaft No. 2.

The known veins occur in a schist belt, run northwest with a 65 deg. N.E. dip, and consist of quartz, talcose schist, and clay containing copper pyrite, with pyrite and a little gold, silver, and zinc. Ore treated at the smelter averaged 5 percent copper, 23 percent iron, 5 percent zinc, and $2.50 in gold and silver. Inasmuch as the present operators are interested principally in zinc production, attention will be given to those sections containing high values in this metal. Rehabilitation was started late in May, 1943. This involved building of a new headframe over shaft No. 2, repair of surface structures, and installation of mining machinery. Pumping is done with air lifts using wooden pipes, and by December 1943 about 80 percent of the water had been removed, making workings in shaft No. 2 accessible to 700 ft. Production of ore left by former operators is expected to start shortly. Present plans include exploration of territory between the two shafts. The mine output will be trucked to the Eagle Shawmut 500-ton flotation mill, 65 miles distant, which has been treating gold ore mined from the partnership's Eagle Shawmut mine at Chinese Camp, Tuolumne County, for several years. From 25 to 30 men are employed at the Penn property, under the direction of Roger Peet. D. C. Peacock manages both the Eagle Shawmut and Penn properties.

Newton Reopened

A short distance north of the Calaveras County line, near Ione, in Amador County, is the Newton copper mine, which is again producing after many years of idleness. Opened in the early sixties, it is one of the oldest copper producers in the State. Production since discovery has been intermittent. On two occasions, in 1889 and 1899, when operated by the Newton Copper Co., an 80-ton smelter was installed to treat ore averaging 7 percent copper. In 1891, leaching ore for cement copper was started, and continued for several years. The precipitated cement contained from 75 to 80 percent copper. Current activity dates back to July 1943, when Winston Copper Co., of which Wayne Loel is president, took over a lease held by J. H. Lester, and installed a surface plant, including a wooden headframe, and began unwatering.

The mine is developed by a vertical one-compartment shaft, with levels at 100, 150, 200, 250, 300, 350, and 400 ft. Ore is mined by cut-and-fill from a fissure vein in amphibolite schist, probably of Carboniferous age. The oreshoot is about 400 ft. long. Since August, 1942, about 3,500 tons carrying 9½ percent copper has been mined from workings above the 200-ft. level and shipped to a Utah smelter. Diamond-drill holes put down from the lowest level by the U. S. Bureau of Mines have disclosed ore at depth, though somewhat lower in grade. Mined ore is hoisted in a skip by a one-drum hoist driven by a 25-hp. motor. A 3-in., two-stage centrifugal pump is available to pump accumulated water to the surface. Output is trucked to rail near by. Operations are directed by Hal M. Lewers, superintendent, who has 45 men under him.

What's Ahead for Gold and Silver Money?

A PLATFORM FOR THE MINER

EVAN JUST, *Associate Editor*

Engineering and Mining Journal is well aware that to undertake an objective discussion of monetary policy is like poking a stick into a hornet's nest, inasmuch as many of its readers have strong views on the subject. However, despite the fact that whatever is candidly said is bound to provoke criticism from some quarters, it is with a desire to serve most those parties whose bread and butter is tied up with the production of precious metals, in whole or in part, that this article is presented. E. & M. J. believes that miners are indulging in wishful thinking on the outlook for gold and silver by leaning heavily on favorable new factors in a picture which is complex and has unfavorable aspects as well. As a journal serving their interests, it believes that its primary duty is to present them with facts as straight as its abilities permit, in the belief that an army is poorly equipped which does not know the strength of the adversary as well as its own.

Comments to the Editor, either confidential or for publication as letters, will be welcomed.

WITH LOOSE TALK being widely bandied about concerning monetary policy, ranging all the way from $120 gold on the one hand to baseless managed currencies on the other, producers of gold and silver and investors in mining properties are naturally confused over the outlook for these metals.

What the miner and the investor want are realistic answers to the following questions: Will the postwar demand be unlimited? What prices will prevail? What will be the status of these metals in postwar currencies?

Realizing the widespread uncertainty over future monetary policy and the great stake of the mining industry in the problem, *Engineering and Mining Journal* set out to canvass expert opinion on this subject in the hope of serving the industry by finding answers to the above questions. Also, knowing that the mining industry is only a minor factor in the determination of international monetary policy, the *Journal* sought to develop a monetary platform for the industry that would reflect enough informed opinion to have weight in monetary circles. A platform that has no substantial backing among specialists on the subject, however gratifying to its proponents, is bound to be dismissed with slight consideration as the selfish viewpoint of a special-interest group.

Next Two Years Important

It is not necessary to recall to the mining industry how important gold and silver have been to its general economy, not only as sources of revenue but as the spur to exploration and development which has laid the foundation for much base-metal production. However, it may be useful to remind the industry that after more than a decade of unstable international trade and monetary "monkeying," the currencies of the world are in a chaotic state. Whether by intelligent planning or through sheer necessity, monetary policies are due to be laid down in the next two years that are likely to determine the nature of currencies for a generation. Therefore, if the mining industry wants to take action to make its weight felt in the councils, the time to do so is now and not after policies have crystallized.

No Formula for Chaos

The reader should keep in mind that the views here expressed assume that control will be maintained over financial conditions. Although this is certainly the most likely situation, we cannot shut our eyes to the possibility of panic until the government displays some capacity to balance its budget and pay its debts in the same terms of effort and resources under which they were contracted. However, it is impossible to state in advance at what point in an unbalanced financial program a debacle may occur. Ten years ago many of us were worried over the possibility of a government debt exceeding fifty billion dollars. There is actually less worry evident today when a debt of 300 billion is in prospect.

The same problem exists on the international scene. If governments pursue courses which undermine confidence, international dealings are likely to lean heavily on an established medium, i.e. gold. If widespread confidence exists in the honor of governments and their abilities to repay in kind, the use of various forms of paper

THE OUTLOOK SUMMARIZED

GOLD—Its international status as a currency base and as a settler of trade balances seems secure . . . Its statutory price is not likely to increase or decrease for several years . . . Future purchases of it for money may be limited if its domestic status is not improved.

SILVER—The international outlook for this metal as a monetary base is doubtful. To help it internationally calls for positive and intelligent action.

is likely to be much more feasible.

Reducing the possibility of financial chaos to its meaning for the gold or silver miner, it is fair to assume that his relative status would be improved rather than depreciated in a period of widespread lack of confidence, simply because the demand for gold and silver for hoarding will be much greater. Therefore, from his viewpoint the outlook described is on the conservative side. As for the mining industry at large, more is likely to be lost through a contraction of trade than will be gained in gold and silver income.

Who Determines Monetary Policy?

Before discussing the outlook it may be profitable to recall how monetary policies are determined. Modern currency systems are established by legislation; therefore the members of Congress and their foreign counterparts are highly influential, as are also government officials concerned with fiscal policies and administration. The next most influential group consists of economists specializing in money and banking problems. Most of these experts are in government bureaus, in colleges and endowed institutions devoted to economic studies, and in the employ of the larger banks. Because the subject of monetary policy is intricate and voluminous, government officials, legislators, and banking houses lean heavily on expert opinion in formulating currency programs.

However, despite the rarefied atmosphere into which the monetary organism reaches, it draws its sustenance from very common and ancient soil. Except in those countries where domestic currency problems are resolved by firing squads, any currency system must endure the test of acceptability to the public at large, from the lowest to the highest. Nothing except stark terrorism can effectively prevent people from shunning fiat currency—which includes all modern systems in considerable degree—if they lose confidence in the integrity of the issuing government. The leaning toward gold and silver under such conditions is based partly on sound common sense as to their enduring commodity importance and partly on ancient tradition which has recognized these metals as standards of value ever since the Stone Age. Exasperating as the primitive roots of monetary policy are to some of the proponents of managed currencies, nobody has yet demonstrated a means of keeping the plant alive without the roots except by force, and that only within national boundaries. In other words, there is no present likelihood of establishing international monetary policies without employing precious metal. Thus the brighter side from the miner's viewpoint. On the darker side is the circumstance that every modern nation's allegiance to precious metal is partly lip service and will continue to be so as long as there are restrictions on the redeemability of the currency base.

Modern Currency a Compromise

To be realistic, we must recognize that every modern currency is some sort of a compromise with a hard-money ideal. A genuine hard-money system would be one in which only coins circulated, or certificates proxying for an equal value of such coins, the latter being completely redeemable. Considering the volume of modern trade there is not enough monetary metal in the world to establish such systems without putting prices on these metals that would be utterly fantastic and would injure their traditional positions as stores of value. Also, such a system is too inflexible and disciplinary for what are generally accepted as modern needs. Therefore, the hard-money advocate must content himself with some sort of a compromise, wherein only a fraction of the notes issued are represented by precious metal in the vaults. Under such conditions there naturally must be some qualifications as to redemption, as all the paper in circulation cannot be honored simultaneously. Whenever redemption is qualified, there begins a succession of modifications which afford no well-defined boundaries between that point and completely managed money.

It is now generally realized that a nation's competency depends as much on its ability to muster resources and human effort as on the assets locked up in its treasury. Therefore, it can be anticipated that the future international status of a nation's currency will depend heavily on its capacity to marshal manpower, industrial capacity, and raw materials, plus a willingness to honor its obligations in a straightforward manner.

It would also be unrealistic to fail to recognize that the historical trend has been toward greater and greater management of currencies. Unfortunately for the miner's interest, there is little reason to expect a halting of this trend unless we are destined to go through a period of trade stagnation, social turmoil, and monetary chaos that will unseat confidence in money management and set us back nearer a world of barter and strictly hard money.

Position of Gold Secure

Turning to the attitudes of various expert groups, the academic, bank, and government economists, the most important fact to the gold miner is that nowhere is there substantial opposition to the continued use of gold as a monetary base. Even those parties who privately regard the reverence for precious metals as a relic of barbarism have no hope of an early divorcement of precious metal from currency systems, and advocate the continued use

of gold as a means of sustaining public confidence.

The "hardest-money-minded" group are the bank economists, who in general would like to return as close to a gold standard as the times permit. They are unsympathetic to the idea of pyramiding an international system of credits and controls on top of the present national systems, as the Keynes and White plans propose to do. They would restrict any international accord to a clearing system, without credit functions and without coercive power in currency matters. Beyond believing that the extension of such credit would in turn require coercion which would result in intolerable complications, the banks, like industry, are private-enterprise minded. They perceive in managed currencies a foothold for totalitarian principles, and a gold standard as a check on official authority, tending to protect both private enterprise and democratic institutions. Also, they foresee that an international credit bank would probably drive private banking from the field of international credit.

Although the academic group of economists entertains all kinds of views, the preponderance of opinion is moderately hard-money minded, and leans toward modified gold standards and gold-exchange standards.

The government group show the least reverence toward hard money. Nevertheless, excepting a few individuals, it would be decidedly unjust to infer that they entertain prejudice against either gold or silver or that their views lack sincerity. They are in the best position to assay international official opinion and to understand the extent to which every modern monetary system is susceptible to official "monkeying." However, despite some doubts as to the long-range future of metallic-based currencies, the general view is in favor of including gold in monetary systems, national and international.

Recent demands for gold have greatly strengthened the position of the metal as a store of value. These include the requests for gold rather than dollars on the part of several foreign governments having credit balances in this country. Also, private demands for gold in such countries as India, China, North Africa, Argentina, and Mexico at prices well above the United States government price have made monetary specialists less disposed to do without gold. A peak price of $77.25 per ounce was paid in India in May, 1943, and private transactions have been rumored in the Orient at prices exceeding $100 per ounce. It is to be noted, however, that these prices have prevailed in places where both demand and supply are limited. Also, in some cases, dollars have been at a discount.

In speculation as to the future of gold, much is made of the stake of the American, British, and Russian governments in maintaining a character for gold, ourselves as the largest owner, the British Empire as the largest producer, and Russia as a producer of considerable consequence and future. The assumption is made and is probably valid that these governments will be the strongest factors in determining international monetary policies, and in so doing will not forget their selfish interests.

Indifference to Redeemability

On the unfavorable side is the circumstance that most monetary economists see gold's modern function as a settler of international balances, and are indifferent to its domestic status or redeemability. Modern domestic currencies, except where the financial integrity of governments is widely doubted, are so bound up with restrictions and controls that the disciplinary effect of a precious-metal foundation is virtually sealed off. This includes the Federal Reserve System, which began in 1922 to make the volume of money and credit independent of gold reserves. How effectually the domestic function of gold is hamstrung was demonstrated when devaluation of the dollar in 1934 failed to affect the domestic price level to any important extent. Not only was the ratio of foreign to domestic trade too small to produce a quick reaction, but the practices of non-redemption and sterilization insulated the inflowing gold from our domestic economy. Domestically, our gold stock has been pretty much degraded to the position of a sterile hoard.

To reduce gold's function to the settlement of international balances will probably be something of a straitjacket for its future, considering the practice of earmarking and the intention of governments to make international trade a more even exchange than in the past. For these reasons, and others discussed below, the gold miner should show less complacency about the status of gold in domestic currency policies.

Lest readers think we are unduly alarmed on this subject we quote from a recent article by a vice president of the Federal Reserve Bank of Kansas City (Pamphlet No. 8 of The Monetary Standards Inquiry, "The Postwar Rôle of Gold," by Charles O. Hardy):

"An unfortunate feature of the story (referring to the Tri-Partite Agreement of 1936) is that this use of gold has involved the maintenance of activity in the gold mining industry of the world at the rate of more than a billion dollars a year, to no good purpose. The only merit of the gold standard is that it reduces the need for credit management; when gold no longer performs that service gold mining becomes sheer waste."

" . . . The immediate postwar period will be a very opportune time to do this (to deprive gold of its present monetary market), however, because, except in South Africa and Russia, the industry is already to a considerable extent demobilized."

Summarizing expert views on the subject of gold, the area of doubt and discussion seems to lie between gold and gold-exchange standards. The outlook for gold as a monetary base is firmer than its actual position during the late thirties.

Keynes and White Plans

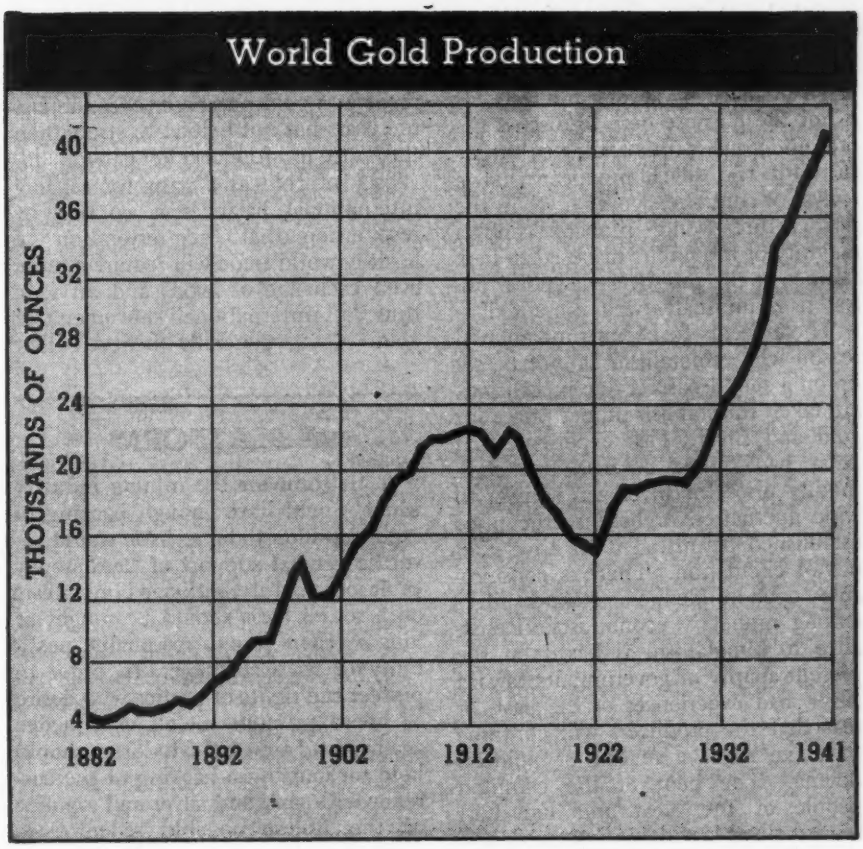
Although it is not the purpose of this article to discuss the feasibility of the plans offered for international currency stabilization and credit, having described some adverse views it is only fair to the proponents of these plans to mention some justification for their proposal. The primary objective of both of these plans is to create a new source of credit to finance world reconstruction. There is room for doubt that the amount of reconstruction necessary for a high level of world productivity, prosperity, and trade is a good credit risk without some collective means of enforcing sound fiscal policies. A second objective is to prevent a rash of monetary panaceas, such as devaluation, the results of which are more harmful than helpful in the long run, both to the nation involved and the world at large.

Both the Keynes and White plans contemplate the use of gold. However, gold is more strongly entrenched in the White plan and could be less readily divorced from it. Both plans create new international monetary units, known as "bancors" in the Keynes plan and "unitas" in the White plan, which are defined as given weights of gold. The White plan involves a capitalized bank based in part on gold reserves, whereas the Keynes plan does not contemplate any capitalization. Because both plans afford new credit powers without broadening the hard-money base, they are elaborations of currency management. Therefore, although they temporarily improve the status of gold, their acceptance would probably threaten its long-run future.

In this connection we quote again from Hardy (*ibid*): "If the currencies of the world are stabilized on the basis of any plan of currency management with credit transactions rather than gold movement serving to equate the balance of payments, further additions to our gold stock would serve no useful purpose. Whether the currencies are tied together by bilateral and multilateral agreements as they were in the late thirties, or more closely integrated through an international fund or clearing union, gold does not fit well into the scheme. It has probably been introduced in order to protect the interests of gold producers and the holders of gold balances." . . .

"This is not meant to imply that a gold standard is better than a silver standard, or a 'managed' paper standard better than either. At some periods within the past 60 years a silver standard would probably have been more stable than the gold standard actually was; at other times less stable. Paper standards may be so managed as to give better results than a metallic standard, and there is great risk they will give worse results, as they have frequently done in the past. The point is that when, for better or worse, the world committed itself to gold, the continued purchase of silver by national governments ceased to benefit any one but the silver interests. Likewise, if the world commits itself definitely to a scheme of managed currencies, whether nationally or internationally controlled, continuance of large-scale purchases of gold will benefit no one but the owners and producers of gold and the communities that depend on them for support at the expense of the rest of the world."

An interesting circumstance is that the relative indifference of the Keynes plan to gold is a reflection of British public opinion. Notwithstanding that the British Empire is the greatest producer of gold, it is understood here that there would be widespread resistance in Great Britain to the reestablishment of the gold standard in the near future. The reason seems to be that the gold standard imposes a certain discipline on fiscal authorities, and Britain, impoverished by the war and uncertain of many aspects of its economic position in the postwar world, is unwilling to bind itself at present to any course which might curb its economic freedom of action in the protection of British interests. To the miner this fact is important because it seems impossible to set up any international monetary accord without British support. Thus, the present British attitude is a barrier to the immediate furtherance of "hard-money" objectives.



Outlook for Bimetallism

Much as we would prefer to report a better outlook for silver, honesty compels us to state that the future of silver as an international monetary base seems to be decidedly uncertain. The viewpoint is widespread that silver has become a political football in this country, and is not susceptible to the rules of reason. In those countries where silver has traditional prestige and the greatest popular demand, governments hesitate to embrace a silver or bimetallic standard for fear of having their currencies disrupted by American politics. If parties whose interests are identified with silver production have any realistic desire to improve the international position of silver as a monetary base, it is high time to take action by assuring the silver-minded countries that we will not resort to arbitrary political action and will support the determination of a silver price by international agreement.

However beneficial it is to producers to have the United States government pay prices for precious metals against which other nations will offer no substantial competition, it is the general opinion of the monetary economists consulted in this survey that such a condition is distinctly against the long-run interests of the producers. The reason is simply that any influence which tends to concentrate the world's stock of monetary metal in one or a few spots is bound to drive the have-not countries in the direction of managed currencies.

There can be no doubt that the general position of silver has been improved by the new industrial uses which have developed during the war, such as in brazing alloys, bearings, and electrical contacts. It is anticipated that most of these uses will continue after the war and will do much to strengthen the demand for silver as a commodity. Also, the increased circulation of silver coins in many countries affected by inflation, including Far and Near Eastern and several Latin-American countries, has given silver new prestige as money. However, up to the present the gain has been entirely in the field of subsidiary coinage and has not rehabilitated silver as a currency base.

A circumstance that the silver producer cannot afford to ignore is the amount of ill will which has grown up in the more populous sections of the country. When the Green bill, affecting the disposition of silver during the war, was being considered by Congress, abundant editorial and individual comment from all sections east of the Mississippi—and some west—unanimously condemned the silver purchase program as a swindle of the majority by a selfish minority. Most of these vociferous writers were unac-

quainted with the merit on the side of the silverites; also, antagonism was stimulated by a strong publicity campaign financed by jeweler interests. It is not the purpose here to discuss the pros and cons of this affair but simply to warn the silver producer that a revival of controversy over silver in the near future would probably find a majority of the public disposed to look askance at the pro-silver viewpoint unless it is unusually well presented.

There seems to be no fundamental reason why bimetallism cannot be set up on a sound basis if due precautions are taken to establish proper prices for gold and silver. Past experience has been bad either because the commodity price for silver was subject to wide fluctuation or because the price established permitted it to drive gold out of circulation. There is considerable open-mindedness toward silver among monetary economists. Resistance to bimetallism is based on the present apathy of governments toward silver, bad experiences of the past, or fear that the producers will continue to make silver a matter of political dogma. The bent of the common people of the Near and Far East toward silver is widely recognized; also the circumstance that the needs of these nations must be taken into account in any truly international monetary policies.

The silver miner should be deeply interested in the views of a man who among those contacted was the best informed as to the attitude of foreign governments and the American public toward silver. His opinion was that the needs of wartime have provided substantial justification for the accumulation of silver stocks by the government. He believed that the general American public is indifferent toward the price of silver, be it 25 cents or $1.25. In the international field he described the attitude of foreign governments (except those with a strong producer interest, such as Mexico and Peru), including those of the Near and Far East, as being so apathetic toward silver as a monetary base that he foresaw no possibility of securing international acceptance of bimetallism. His view was that the demand of the Oriental citizen for silver would be met by the abundant distribution of silver coins without including silver as a monetary base.

Probable Price of Gold

Dashing as the observation may be to the hopes of those parties who are expecting gold to go to two or three times the present price, we find little expert opinion to support the belief that the price of gold will rise.

This attitude is supported by several circumstances. The slight competition which has been offered to our government as a gold purchaser over the last ten years has not helped to strengthen the price position. The general advocacy of gold as a basis for settling international balances is colored by recognition that the restoration of healthy world trade will require a more even exchange of goods and services, thus less international movement of gold. It is generally believed that there is enough gold already above ground to perform this function in a world of healthy trade. Therefore the economists believe that if currency devaluation occurs, heavy taxation or seignorage will be imposed on new gold to prevent the stimulus to gold production that might otherwise occur. In fact, there would probably be small complaint from most monetary specialists if some restraints should be placed on gold output at the present price.

On the other hand, it seems as though there is enough strength behind gold to sustain the present price for some time to come. To lower the price would involve a loss to the owners of gold and income reductions to gold producers. Inasmuch as these categories include those nations which are likely to dominate the postwar world, such a move does not seem probable. Recent premium prices paid for gold and the demands for gold by creditor nations suggest that the United States government may not be the sole bidder for gold in the future. The probability that Oriental nations will become relatively stronger after the war is favorable to precious metals, considering the penchant of Orientals for hard money. Also, there is the private banker element, which would prefer broadening the gold base to the growth of currency management. Finally, there are the multitudinous advocates of private enterprise, who, to the extent that they are informed on currency matters, view the gold standard as a check upon bureaucratic excesses. Considering all these factors, along with the traditional status of gold in the public mind, it does not seem likely that any broad move to reduce the gold price will develop in the near future.

A PLATFORM

A platform for the mining industry which would have enough backing in expert opinion to be realistic would advocate general support of hard-money philosophy. International bimetallism on a sound basis should be sought as long as there is any reasonable possibility of its acceptance. In order to protect the rights of parties who desire to hoard precious metals as a hedge against hard times, the industry should hold for maximum backing of the currency with gold and silver and a policy of the fullest possible redemption. Gold should not be contraband at any time. There should be free coinage of gold—and silver under a bimetallic standard—with no seignorage beyond brassage. The dissemination of such a program would be compatible with the public interest and the long-run interests of that portion of the mining industry producing precious metals.

Educational Program Recommended

The miner is likely to say, "This is all very well, but what can I do about it? What is the use of the mining industry having a monetary platform when it is nothing but a spectator in the determination of monetary policy, particularly on an international basis?"

There is considerable merit in such questions. The miner is something of a spectator in an empire where three great commonwealths, all heavily dependent on gold production, have so little influence that the mother country is holding the gold standard in abeyance. When the United States devalued the dollar in 1934 the benefit which the gold miner received was purely incidental to a policy conceived entirely without his participation.

Nevertheless, these results do not mean that the miner could not take action that would be both profitable to himself and in the public interest. To be effective, a program would certainly require the expenditure of more effort than he has been accustomed to devote to such ends. Also, it seems as though effective action must take the form of public education on monetary matters and the virtues of precious metals as stores of value. It is useless to disseminate information which is patently serving a special-interest group, as the recognition of a selfish interest will cancel the weight of the arguments in the reader's mind. Any effective educational activity must be based on the honest furtherance of sound public policy, undertaken in the light of the miner's faith that sensible currency practices and a broader interest in monetary policy will react to his benefit.

The present tendency to leave monetary problems in expert hands is no advantage to the cause of hard money, which is essentially a people's move-

ment. In a bureaucracy a greater public interest in currency problems would undoubtedly react in a hard-money direction, because hard money leaves less license in the hands of officials and reduces the opportunity of governments to cheat their citizens.

Miner's Stake in Hoarding

One circumstance that the gold or silver miner should keep constantly in mind is that in currency matters his fortunes are closely tied to those who would hoard wealth in uncertain times. The hoarder is a spectral figure to public officials, as his fears tend to complicate their fiscal problems. However, to the miner he is indispensable, as there would be no need for stores of value or currency bases if the desire to hoard should disappear. Therefore, in his own interest the miner should protect the right to hoard and could do worse than to propagate the thought that a little hoarding on everybody's part is not a bad idea.

Thus, recognizing the fundamental interest of the miner in hoarding, it might be worth while to scrutinize what monetary policies are conducive to hoarding and what are discouraging. Beyond the unrestrained opportunity to hoard if he so chooses, the hoarder wants the unrestricted right to obtain gold or silver in exchange for the government's paper. Neither of these rights applies to gold in this country today. Also, to guard against the evil days against which he sterilizes his wealth, he wants metal of good fineness and minimum seignorage. What is most embarrassing to the miner, the hoarder wants established prices for the monetary metals to be as close as is feasible to their probable natural levels. Thus, his store of wealth will have the highest possible conversion value in case the economic system has to go "through the wringer."

There seems to be no basis in equity for making gold contraband in private hands, as was done by our government in 1934. The justification offered for this move was that the owner of gold was not entitled to a gratuitous profit, created solely by a change of government policy. However, if such reasoning is pursued to its logical conclusion we would end up with nothing less than complete socialism. From the miner's viewpoint, this discouragement to hoarding is unwarranted. The hoarder is just as much entitled to the appreciation of his property as the investor, speculator, or farmer who benefits from changes in government policy.

In the matter of seignorage, the miner should remember that its encouragement is likely to bring him distasteful results if it should be generally believed that there is enough monetary gold to perform its appropriate functions. Beyond brassage (i.e. a charge to cover the cost of minting), seignorage has no justification unless one assumes that the government is entitled to profit at the expense of its citizens.

Maximum Redemption Desirable

As stated above, most monetary experts are indifferent to domestic redemption of currency, and consider that the essential role of gold is to settle international trade balances. Most of them do not fear that the denial of monetary gold to individual citizens will undermine the status of gold in international dealings. They believe that the situation which prevails in this country today could go on indefinitely.

With this viewpoint the writer cannot agree. The use of a tangible monetary base becomes an empty safeguard when the citizen who holds the government's paper cannot secure the monetary metal in exchange. Furthermore, if through the practice of non-redemption people become accustomed to having no access to monetary metals, it is probable that individual interest in hard money will disappear. Inasmuch as the worth a government attaches to gold or silver cannot permanently be more than the worth in the eyes of its citizens, it follows that perpetual non-redemption on a domestic basis will eventually undermine international faith in monetary metals as stores of value. The technical utility of gold as a balance settler is not likely to survive if widespread belief in its more-than-commodity value disappears. Therefore, in both his own and the public interest the miner should hold for the fullest possible exercise of the right to redeem. It is also true that the present policy discriminates between the citizen and the foreigner in favor of the latter.

Although redeemability is simple common sense in a metallic-base currency, for reasons stated above the hard-money advocate cannot expect to realize it under all possible conditions. We are told as a flat fact by those in the best position to know that very few foreign governments would consent to domestic redemption at the present time or in the discernible future, simply because they do not have sufficient gold stocks to make it feasible. Many countries expect to have a hard time meeting outside demands for their gold. Also, it is pointed out that under our system, with its statutory provisions for a minimum backing of the currency by gold and silver, there could be times when domestic redemption would pull down the government's gold supply to a point where contraction of the currency would be required. Experts believe that suspension of gold payments is less disturbing to confidence than alteration of the requirements for currency backing. They also believe that the people simply would not stand behind currency contraction as a means of supporting redemption when it is taken into account that such a condition would occur only during a depression wherein the resulting fall in prices would strengthen the depressive influences. Although it may be argued that such stern correctives might accomplish the cure in minimum time, it can scarcely be expected that the people will support Spartan measures in times of distress, with politicians offering all kinds of economic panaceas.

Thus, the best that we can expect to secure is a policy of redemption at all times when the same does not endanger the government's credit position. There was no good reason, for example, why the citizen should have been denied access to gold between 1934 and the beginning of the present war, either through redemption or by purchase directly from the miner.

In summation, the probability that gold will continue as a currency base seems unquestionable for the discernible future. Nobody has yet devised an alternative means of settling international trade balances which is universally acceptable. The price of gold does not seem likely to rise or fall if the means is found to prevent civilization from disintegrating. Future national and international stability would probably permit the pyramiding of credit relatively to the currency base, thus continuing the historical trend toward money management. If on the other hand conditions should become more chaotic, widespread lack of confidence may improve the positions of precious metals as stores of value.

The outlook for silver as a currency base is dubious. A favorable international result is not likely unless steps are taken to assure the world of our determination to take silver out of politics and our willingness to settle the price by international agreement.

It seems advisable for that portion of the mining industry having a stake in precious metals to support a campaign advocating the hard-money viewpoint, provided that is done with full regard for the public interest, and national and international good sense.

Chlorine as a Solvent in Gold Hydrometallurgy

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SIXTY YEARS AGO, when chlorine was prepared by chemical instead of electrochemical action and was worth 35c. instead of 1.75c. per pound, gold ores were treated on an extensive scale by roasting and subsequent leaching with aqueous solutions of chlorine (Reference 27). Recoveries of 90 to 98 percent, with chlorine consumptions of 1.5 to 5 lb. per ton of ore, were not unusual. The gold-bearing solutions were reduced with ferrous sulphate or hydrogen sulphide, and the precious-metal content was recovered by sedimentation. Later, with the introduction of the cyanide method, discovered by Elsner (8) and Faraday (10), and advocated by MacArthur, Forrest, and Forrest (23), the chlorination process was soon displaced, abandoned, and forgotten.

We believe, however, that developments since 1888 merit a reconsideration of the chlorination process. Cyanidation does have serious disadvantages, such as:

1. Oxidized copper minerals form stable cyanide complexes which in lime solutions are valueless as gold solvents. Because of the high reagent consumption, ores containing as little as 0.2 percent of oxidized copper are frequently not amenable to cyanidation (5).

2. Since a basic leach solution is required, all iron sulphates and free acids must be neutralized with lime. The cost of the lime is often an important item (25).

3. The gold particles dissolve slowly. In some instances the ores must be leached for 3 to 10 days to secure reasonable recovery (25).

4. Gold cyanide ion is strongly adsorbed by graphite. There is no evidence that gold chloride is adsorbed by carbon in the presence of an excess of chlorine (14).

5. Sodium cyanide consumed in the process represents a major cost item (25). The price of sodium cyanide, in cents per pound, is now about eight times that of chlorine (2).

The prior art of the chlorination of gold ores is summarized in several of the older metallurgical treatises, including Greenawalt (13), Eissler (7), Aaron (1), Kustel (18), and Schnabel (28). Although chloride solutions have been extensively applied to the leaching of silver and silver-gold ores, the processes were based entirely on the well-known solubility of silver chloride in concentrated chloride solutions (13). It was also known that gold would dissolve more rapidly in the presence of "nascent chlorine" (17), and the "nascent chlorine" solutions generally contained chloride ion; the chlorine was generated in the presence of the ore by chemical action (13). Nevertheless, as far as we can determine (12), no one has previously shown that the addition of chlorides to a chlorine solution will hasten the dissolution of gold particles therein.

Methods

Three general methods for determining the activities[1] of gold solvents were considered:

1. Determination of the loss in weight of gold particles of uniform dimensions, weight, and composition when subjected to the solvents under constant conditions.

2. Determination of the amount of gold dissolved by the solvent by analysis of the solvent.

3. Determination of the time required for the solvent to dissolve gold particles having uniform dimensions and compositions.

Regarding Method 1, the time required for each test would be large and the work would therefore be limited in

[1] We define the activity of a solvent as being inversely proportional to the time required for the solvent completely to dissolve uniform gold particles under the experimental or industrial conditions.

References and bibliography at the end of the article.

Table I. Reproducibility of the Gold Leaf Test

Series No.	*Reagent in Solution, Grams Per Liter*	*Average Time Required to Dissolve Gold Leaf, seconds*	*Mean Percent Deviation From Average*
1	0.5 NaCN	247	7.1
2	0.5 NaCN	236	6.5
3	3.5 Br_2	201	11.35
4	3.5 Br_2	181	6.3

Table II. Effect of Cork on Time Required for the Dissolution of Gold Leaf.

Trial No.	*Seconds Time Required for the Dissolution of Gold Leaf With:* 0.5 g. of NaCN per Liter		1.7 g. of Cl_2 per Liter	
	Glass Stopper	*Cork Stopper*	*Glass Stopper*	*Cork Stopper*
1	200	220	80	78
2	235	210	70	84
3	210	240	81	77
Mean	215	223	77	80

scope. During each test extreme care would have to be taken to have adequate and uniform circulation, and yet avoid all contamination of the solvent[2]; temperature and other variables, including the hydrogen sulphide content of the air bubbled through the solution, would have to be controlled. Because of these facts we did not use Method 1.

Method 2 does not necessarily involve the use of an assay balance, and the time required per test is not great when our chlorimetric method (11) is employed. The results of Table III were obtained by this method.

Apparently Method 3 was first used in 1857 by M. Faraday (10), who wrote as follows concerning the action of potassium cyanide on gold leaf:

"Air-voltaic circles are formed in these cases, and the gold is dissolved almost exclusively under their influence. When one piece of gold leaf was placed on the surface of a solution of cyanide of potassium, and another, moistened on both sides, was placed under the surface, both dissolved; but twelve minutes sufficed for the solution of the first, whilst about twelve hours were required for the submerged piece. *In weaker solutions, and with silver also, the same results were obtained:* from 60 to 100 fold as much time being required for the disappearance of the submerged metal as for that which floating, was in contact both with air and solvent." (Italics mine.)

Reagents—The methods of preparing and standardizing many of the reagents are given in a previous publication (11). All reagents were of C.P. grade. Concentrations of sodium cyanide were determined by the standard method involving titration with silver nitrate, with potassium iodide as the indicator (30). The bromine and chlorine reagents were standardized by pipetting 5 ml. into an excess of potassium iodide solution and titrating with sodium thiosulphate (29).

Regarding the sodium cyanide reagent, it was necessary to make certain that the amount of sulphur in the form of sulphide was less than the amount (0.1 mg. per liter) which has a deleterious action on the dissolving of gold (26). Suitable tests were made to confirm this fact.

Gold leaf used was the 23-carat, XX-grade manufactured by the W. H. Kemp Co., of New York, N. Y. The alloy contains a small amount of copper and has a nominal composition of 95.8 percent gold. The weight was found to be 0.206 mg. per sq.cm., corresponding to a thickness of 0.11 microns, or 4 millionths of an inch.

To determine the reproducibility of the gold-leaf solution test, uniform squares 3x3 mm. were prepared by placing a gold leaf between two sheets of paper and cutting with a scissors. Several No. 3 cork stoppers, not used previously, were then moistened with water and placed in a covered 250-ml. beaker. By removing the paper from one side of the gold leaf and placing the gold in contact with the bottom of the cork, the gold leaf adhered and retained its original square shape. All corks with adhering gold leaf were kept in a covered vessel until just before use, as it is important that the corks do not dry. To each of five 10-ml. test tubes was added 5 ml. of the reagent being tested, and the tubes were stoppered with corks having adhering squares of gold leaf. All test tubes were then vigorously shaken by hand at a uniform rate of about three oscillations per second. The time of solution was taken as time at which the particles of dissolving gold leaf became invisible.

A large excess air supply was present over that required to dissolve the gold leaf. Five ml. of air is more than a thousand-fold excess of oxygen over the amount required to dissolve a 3 mm. square of gold leaf. Furthermore, there is less danger of introducing hydrogen sulphide than would be the case if a vigorous stream of air were passed into the solution.

In Table I are given some results on the reproducibility of gold-leaf test, five trials being made simultaneously in each case.

Table I shows that the mean deviation of the results from the average is between 6 and 11 percent.

We then made tests to determine whether the cork had much effect on the time required for the solvents to dissolve gold leaf. Three 60-ml. glass-stoppered bottles were used, and comparative tests made by replacing the glass stoppers with corks. Twenty-five ml. of reagent were used per test, other details being similar to those of Table I. The results are given in Table II.

Tables I and II indicate that fairly reproducible results can be obtained by the gold-leaf test. Among the advantages of the test may be cited the following:

Table III. Milligrams of Gold Dissolved per Minute per Square Centimeter of Total Surface Area of Gold Foil.

Trial No.	*Reagent*	*Mg. of Gold Dissolved per Sq. Cm. Surface Area per Minute*
	SODIUM CYANIDE SOLUTIONS	
1	2.5 g. of NaCN per liter	0.04
2	0.5 g. of NaCN per liter	0.05
3	0.1 g. of NaCN per liter	0.006
	CHLORINATED SEA WATER	
4	0.059 g. of Cl_2 per liter	0.003
5	0.059 g. of Cl_2 per liter + 2.5 g. of H_2SO_4 per liter	0.13
6	0.059 g. of Cl_2 per liter + 7.0 g. of H_2SO_4 per liter	0.14
7	0.118 g. of Cl_2 per liter	0.12
8	0.118 g. of Cl_2 per liter + 2.5 g. of H_2SO_4 per liter	0.27
9	1.18 g. of Cl_2 per liter	1.80
10	1.18 g. of Cl_2 per liter + 7.0 g. of H_2SO_4 per liter	1.81
	MISCELLANEOUS CHLORINE SOLUTIONS (DISTILLED WATER)	
11	0.437 g. of Cl_2 per liter	0.06
12	0.437 g. of Cl_2 per liter + 0.5 g. of H_2SO_4 per liter	0.15
13	0.437 g. of Cl_2 per liter + 8 g. of H_2SO_4 per liter	0.53
14	0.437 g. of Cl_2 per liter + 10 g. of H_2SO_4 per liter	0.62
15	2.0 g. of Cl_2 per liter	0.34
16	2.0 g. of Cl_2 per liter + 0.5 g. of Br_2 per liter	0.32
17	2.0 g. of Cl_2 per liter + 2.0 g. of $CaCl_2$ per liter	0.68
18	2.0 g. of Cl_2 per liter + 8.0 g. of HCl per liter	3.76
19	2.0 g. of Cl_2 per liter + 20 g. of Na_2SO_4 per liter	0.33
20	2.0 g. of Cl_2 per liter + 20 g. of NaF per liter	0.35
	BROMINE SOLUTIONS (DISTILLED WATER)	
21	30 g. of Br_2 per liter	1.84
22	30 g. of Br_2 per liter + 20 g. of NaCl per liter	16.0
23	30 g. of Br_2 per liter + 25 g. of KBr per liter	37.0

[2] We have shown (26) that 1 mg. of sulphide ion per liter may increase by a factor of 6 the time required for a cyanide solution to dissolve gold leaf, and the deleterious action of such minute traces of sulphide ion has heretofore been unknown. Consequently the use of sulphur-containing rubber in contact with the alkaline cyanide solutions would not be permissible.

Table IV. Time Required for Sodium Chloride-Chlorine Solutions to Dissolve Gold Leaf.

Grams of Sodium Chloride per Liter of Solvent	*Seconds Time Required to Dissolve Golf Leaf With Solvents Having Chlorine Concentrations of* 3.46 G./L.	1.73 G./L.	0.691 G./L.	0.346 G./L.	0.173 G./L.
0.00	26	80			
1.09	22	..	420		
2.19	17	40	..	650	
4.58	10	20	55	232	
8.77	7	15	39	105	480
17.5	6	12	30	70	180
35.1	5	9	24	65	105

1. No foreign materials other than cork and glass come in contact with the solution. It will be recalled that in cyanidation practice the solutions generally contact silicates and wooden vessels, as well as the gold.

2. Vigorous agitation is employed, thereby simulating the usual cyanidation practice (25).

3. A series of 5 to 12 trials can be made at one time under identical conditions, and the relative efficiencies of the solvents for dissolving gold leaf established within 10 or 20 percent.

4. The gold is in a uniform condition in all tests and, like some native gold, contains small amounts of copper and silver.

5. The cost of the gold is negligible. At present a book of 25 leaves (8.6 cm. squares) costs about $1.25.

6. The time required per test is less than with any other method. One can therefore study a larger number of solvents and obtain a more complete picture of the essential variables than would otherwise be possible.

Because of its characteristics the test has been used in much of our work. Among the established facts of cyanidation which may readily be confirmed by the gold-leaf test may be mentioned (26):

1. Calcium hydroxide retards dissolution of gold (3).

2. In the presence of calcium hydroxide, soluble lead compounds retard still further the dissolution of gold (19).

3. The presence of lead in solutions of pH approximately 10 is not deleterious in the absence of calcium compounds and is often beneficial (15).

4. Sulphide ion retards dissolution of gold when present to the extent of more than 5 mg. per liter (17).

5. Potassium ferricyanide accelerates the dissolution of gold (4).

6. Traces of mercury salts accelerate the dissolution of gold (6).

7. Copper ammonia cyanide (although it contains no free cyanide) is an active solvent for gold (16).

With the gold-leaf method it is possible to make several hundred tests per day, and therefore the results which we shall present in this and future publications are based almost entirely on findings which are new or bear on contradictory information recorded in the literature. We believe that the seven well-known facts in the cyanidation of gold, listed previously and to be described later in connection with new material, establish the usefulness of the gold-leaf test.

Action of Various Solvents On Pure Gold

Action of various solvents on 24-carat gold foil, 0.1 mm. thick, was first studied. The purity of 24-carat gold is generally greater than 99.9 percent (22). The sodium cyanide, chlorine, and bromine reagents were standardized by the method given under "Reagents." The sea water was taken near Bay Shore, Long Island, during an incoming tide. This location was chosen because the sea water had no evidence of pollution, unlike other coastal waters in the vicinity of New York City. Salt concentration was found by evaporation to be 29.43 grams per liter, indicating that the sea water was diluted to some extent with fresh water.

As a preliminary step, the gold foil was cleaned with pumice soap, washed with distilled water, heated to redness, cooled, and cut into squares 2x2 mm., all squares having a constant area within 10 percent. For each trial of Table III one or more squares, not used previously, were placed in a 10-ml. test tube with 5 ml. of solvent, and the test tube was corked and shaken by hand until about 0.05 mg. of gold had gone into solution, the relative activities of the solvents being approximately known from preliminary tests. Five to ten trials were made at one time. The rate of shaking was about two vibrations per second. At the conclusion of the test the solvent was decanted from

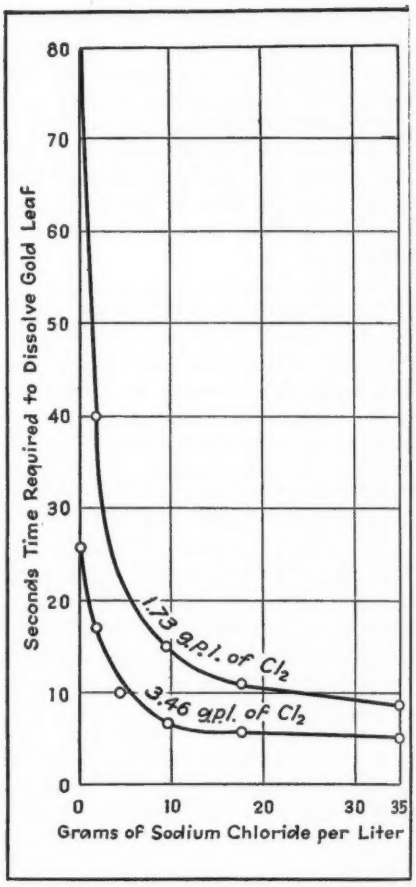

FIG. 1. . . Addition of chloride ion to chlorine solutions accelerates rate of gold dissolution

Table V. Effect of Sodium Chloride on the Time Required for Bromine Solutions to Dissolve Gold Leaf.

Trial No.	*Concentration of Sodium Chloride in Grams per Liter*	*Seconds Time Required For Dissolving of Gold Leaf*
1	0	1,120
2	5	870
3	10	625
4	30	310
5	100	80

the foil and the gold content determined by the low-acid stannous chloride test developed by Fink and Putnam (11).

The data of Table III are interesting from these standpoints:

1. The results indicate that chloride ion greatly accelerates the dissolution of pure gold in chlorine and bromine solutions.

2. Sodium fluoride and sodium sulphate do not accelerate the dissolution of gold in chlorine solutions.

3. Except in very dilute solutions, where hypochlorite formation is an important factor[3], sulphuric acid does not accelerate the dissolution of gold.

4. The dissolution of gold proceeds much more rapidly with the halogen solvents than with the cyanide solvents.

Action of Chloride Solvents On Gold Leaf

To confirm and extend the data of Table III, we then tried the gold-leaf test. The procedure was similar to that used when determining the reproducibility of the test (Tables I and II), with the exception that the squares of gold leaf were 5x5 mm. instead of 3x3 mm. As our principal object was to determine the effect of sodium chloride, the trials of each series had identical chlorine concentrations and the sodium chloride concentration was varied. The three to seven trials of each series were made simultaneously. Results are given in Table IV and Figs. 1 and 2, and are similar to the results obtained in other series of tests.

As shown by Table IV, sodium chloride accelerates the dissolution of gold leaf.

In order to confirm Trials 21 and 22 of Table III, which indicate that sodium chloride accelerates the dissolution of gold in bromide water, several experiments were made by the gold-leaf method (Table V). The procedure was identical to that of Table IV. All solvents had a bromine concentration of 2 grams per liter.

Discussion

The results obtained by two different methods are in substantial agreement (Tables III, IV, and V) and prove conclusively that the addition of sodium chloride to chlorine or bromine solutions accelerates the dissolution of pure gold and of (95.8 percent) gold leaf immersed in these solutions, while sulphates and fluorides (Table III) have practically no effect. The accelerating effect of chloride ion has not been recognized heretofore.

If we assume that the first reaction between chlorine and gold is

$$2\ Au + Cl_2 \rightarrow 2\ AuCl,$$

and that the rate of solution of the gold is controlled by the rate at which the insoluble aurous chloride film is removed from the surface by the reactions

$$AuCl + Cl_2 + Cl^- \rightarrow AuCl_4^-, \text{ and}$$
$$AuCl + Cl^- \rightarrow AuCl_2^-,$$

it is believed that the results are satisfactorily explained. Thus Lengfeld (20) has shown that aurous chloride is insoluble in water but is soluble in sodium chloride. The aurous chloride ion is later oxidized to the auric state, but in dilute chlorine solutions this is not the rate-controlling reaction. As Ostwald (9) said: "In the last analysis, diffusion determines the velocity of chemical change."

[3] The equilibrium constant of the reaction $Cl_2 + H_2O \rightarrow H^+ + Cl^- + HClO$ is 4.84×10^{-4} at 25 °C (21)

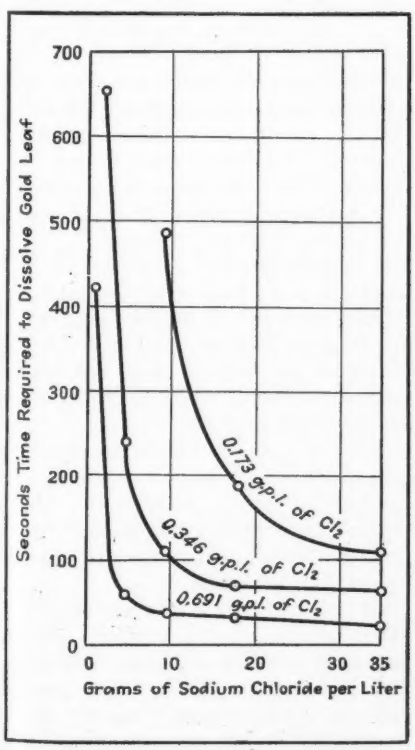

FIG. 2. . . Effect of adding the chloride ion to solutions whose chlorine concentration is low is greater than that shown in Fig. 1

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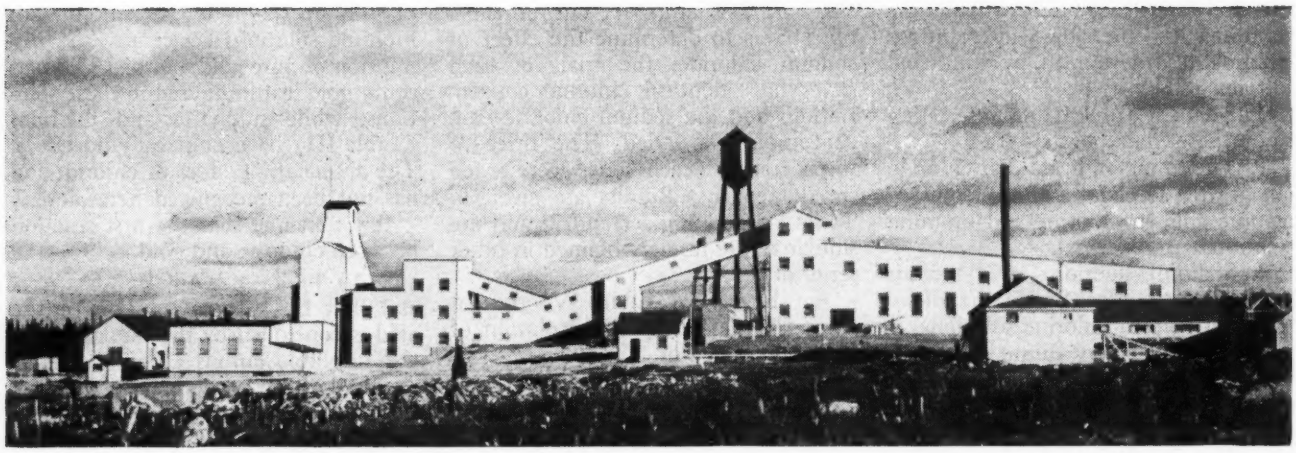


ATTENTION is claimed by Golden Manitou (whose shafthouse and mill are seen here) because of the unexpected occurrence of zinc underground, the mucking-machine stopes, and the ore treatment

Golden Manitou— New Zinc Producer

ANDREW ROBERTSON, *Manager, and* D. A. LIVINGSTONE, *Mill Superintendent, Golden Manitou* Mines, Ltd., Val d'Or, Que.

THE hundred-mile chain of producing mines which reaches from the Kirkland Lake area, in northern Ontario, on the west, across the Provincial boundary to beyond Val d'Or and Bourlamaque, in Quebec, on the east, and which continues to be so productive of gold, is marked at its 60-mile point by the base- and precious-metal producers of the Noranda district, and, again, at its present far-eastern terminus, by the interesting zinc-gold-silver deposit of the Golden Manitou mine, to which attention is here directed. This property is in Bourlamaque Township 8 miles east of Val d'Or by the Provincial highway which runs through this region on its way down to Montreal, 354 miles away. The line of the Canadian National Railways also crosses the property.

Despite its name, the Golden Manitou is notable for its zinc primarily. Here, on the property, the first discovery of sphalerite in this area in important quantity was made in 1937, although the ground had been staked some years before. The mine was brought into production in August, 1942, by the Golden Manitou Mines, Ltd., the present owners, which company had been organized the preceding year. In the past year it has milled approximately 1,000 tons of ore per day, with approximately 300 men on the payroll, of whom about 65 percent were underground. The addition of the new output of zinc has been a welcome addition to wartime needs.

Previously, the deposit had been successively in the hands of three other companies. The first of these, which took charge in 1926, was the Caribou Copper Corp. Title lapsing, J. I. Cummings restaked the property in 1930, and formed the Golden Manitou Syndicate. This was succeeded by the Quebec Manitou Mines, Ltd., to be followed in turn by the present company, which was set up when money was needed to do further development and to build a treatment plant.

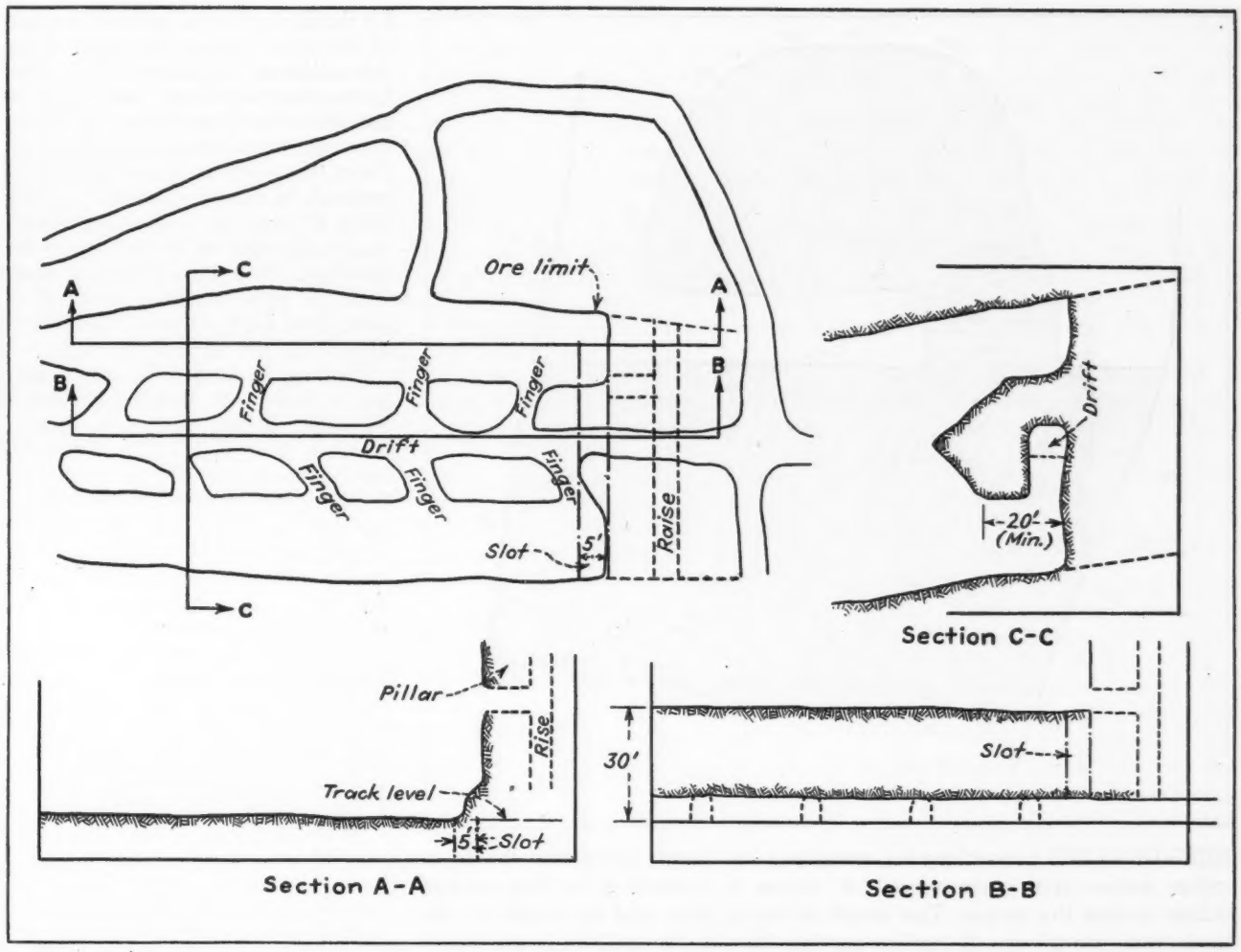
Geology & Mineralogy

Golden Manitou's orebodies occur in a belt of rocks which have been subjected to regional shearing and which lie along the contact of the Bourlamaque batholith, on the margin of which the productive mines of the region have been found. Certain of these rocks being more resistant than others, the shearing is most pronounced in a major east-west zone 100 ft. to 300 ft. wide and at least 4,000 ft. long. Sericite schist formed in this zone has been replaced to form the orebodies, which are disposed generally in two main groups, north and south, with about 40 to 50 ft. of sheared rhyolite breccia between the oreshoots. The ore occurs as elongated lenses of varying width containing sulphide minerals and some quartz and carbonate. The principal orebody is some 800 ft. in length and 15 to 60 ft. wide.

The ore, a varying mixture of pyrite and sphalerite with occasional streaks of galena and other minerals, contains 7½ percent zinc, according to an average analysis; 0.05 oz. gold; and 3-5 oz. of silver. In addition there are minor amounts of lead (0.50 percent) and copper (0.06 percent).

The metallic minerals, in the decreasing order of their abundance, are: sphalerite, pyrite, arsenopyrite, chalcopyrite, tennantite, galena, and tetrahedrite. Native gold and pyrrhotite are found also, but rarely.

In quantity, the gangue material varies greatly. Some samples consist largely of massive sulphides with only a little gangue. Others are mostly gangue. Quartz occurs usually as a fine-textured white vein variety, which in some places shows the schistosity of the replaced host rock. Carbonate, some of it dolomite, occurs in varying quantity both as a replacement of the quartz and as stringers in the quartz.



MUCKING-MACHINE STOPE (No. 203 East) with a raise pillar at the right. The position of the slot which must be cut before starting to recover the stope and floor pillars by ring-drilling is indicated by the dot-dash line

MECHANICAL MUCKING of ore drawn off in shrinkage mining accounts for 60 percent of Golden Manitou's output

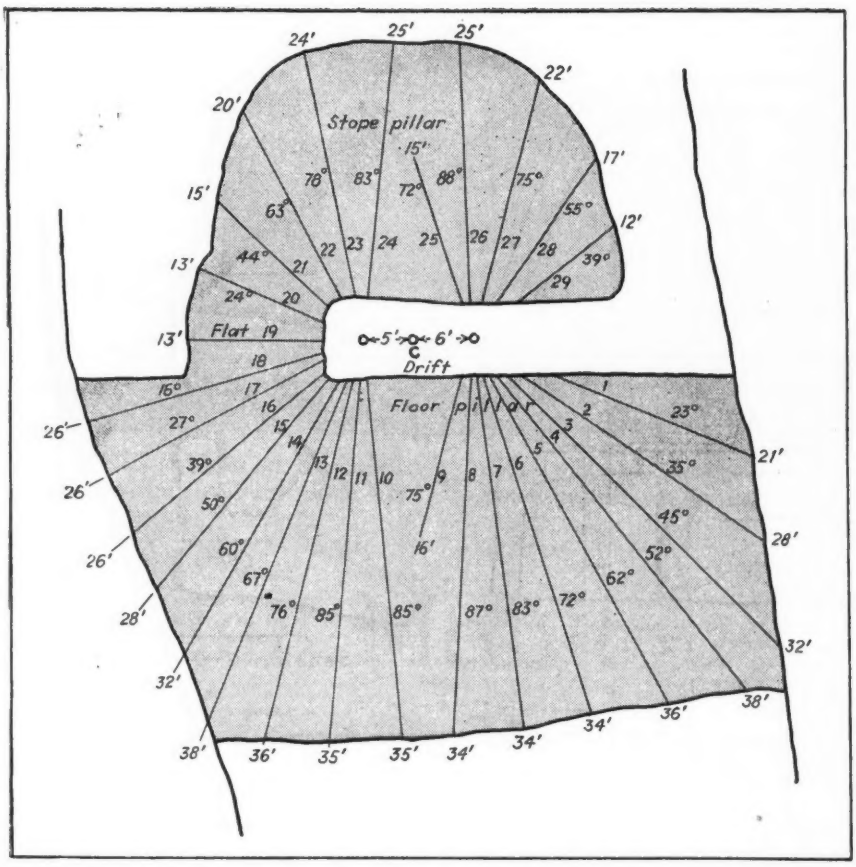
In some places the ore limits are well defined. In general, however, they are not. The zone worked is regarded as a minable mass with minable limits rather than as a vein system. Width mined varies from 12 to 60 ft. The sericite schist zone dips 80 deg. N., a chloritic rhyolite breccia forming the footwall.

Development

The mine has been opened by a vertical three-compartment shaft, which at the end of January was 1,120 ft. deep. A level interval of 150 ft. was chosen, the first level being opened at 210 ft., at which point the shaft is 180 ft. in the footwall. This level and the levels at 360 and 510 ft. are now being worked, and the next three are being opened, the lowest having been cut at 1,110 ft. Diamond drilling from the new levels has proved the downward extension of the ore, providing adequate reserves at the present milling rate.

Mining Method

Mining at the Golden Manitou is done by shrinkage methods, which for stoping widths exceeding 20 ft. and up



RING-DRILLING procedure for removing the stope pillar and the floor pillar below it in successive 5-ft. slices is indicated in this section taken across the stope. The depth of each hole and its angle to the horizontal are given. A similar section through the pillars is shown in Section C-C in the drawing on the preceding page.

to the 60-ft. maximum are characterized by interesting variations in stope preparation which permit the use of mechanical loaders for mucking the ore drawn off. Sixty percent of the tonnage comes from these so-called mucking-machine stopes. The remainder is derived from shrinkage stopes which have been prepared in the narrower orebodies in the orthodox manner for loading from chutes into cars. Ten percent of the total output is supplied by ring-drilling of pillars with diamond drills and is included in the tonnage drawn from the mucking-machine stopes and the chute-loading stopes. Aside from this ring-drilling of pillars, all drilling is done by rock drills.

The principal advantage realized from opening these mucking-machine stopes in the wider portions of the ore is that the company thus gets ore from the start instead of experiencing delay and expense due to driving boxholes and building chutes. Large fragments, moreover, are more readily handled by blockhole blasting on the track level. On the other hand, chute loading is used for the stopes that are 20 ft. wide or less because the fragmentation is more easily controlled in the narrower stope and the broken ore runs freely from the chutes.

Stopes are laid out along the strike of the ore in sections 150 ft. long with a 30-ft. pillar between. Every second pillar has a 5x5-ft. manway raise through it and stope windows (short crosscuts) at 20-ft. vertical intervals for access to the stope as breasting advances.

Mucking-Machine Stopes

Mucking-machine stopes are opened in three different ways, depending on the width of the orebody, location of existing drifts, and other conditions. Where the ore is 50 to 60 ft. wide, an 8x9-ft. untimbered drift is driven on the level down the center of the ore. (No timbering is necessary in this mine in any drift or stope.) From this drift, finger crosscuts 8x8 ft. in section are driven at 25 to 30 ft. intervals to the ore limits on each side.

The next step is to sill out the ground between ore limits to the height of the crosscut and for the length of the stope by slashing, save for the draw-point pillars on either side of the drift between the finger drifts. An additional horizontal lift is then taken above the sill cut, just enough of the broken ore from the sill cut having been mucked out to permit setting up. From this point on, shrinkage stoping proceeds in the usual manner, a pillar being left over the drift of the general shape indicated in the accompanying drawings. In a stope 50 ft. or more wide this pillar would be about 35 ft. wide, 20 ft. high at the sides, and 30 ft. high above the track at the peak.

Drilling, in both drifting and stoping, is done with Gardner-Denver D 89 3½-in. drifters using 1-in. quarter-octagon steel and Craig detachable bits. The bits are used to destruction. In the softer ground it is possible to use one for several runs. Breast holes are put in to a depth of 11 ft. and are loaded with 40-percent gelatin powder and No. 6 caps. Blockholing is done in the fingers—rarely in the stopes.

There are two men to a machine. Tonnage broken averages 80 per drill shift, or 40 tons per man, in this type of work with the kind of miners available. About 400 tons has been broken in 24 hr. in two shifts in 203 East No. 1 stope shown in the drawings.

Mucking is done with Gardner-Denver 9H loading machines, of which there are six in the mine. In the 203 East No. 1 stope there have never been more than two of these machines at a time. A 1½-ton rocker-type side-dump car is used, and one machine will load about 50 such cars in 8 hr. where blockholing of large pieces and cleaning up have to be done. Under best conditions as much as 150 tons has been loaded in 8 hr. by one machine.

Ring Drilling

As stated previously, the ore pillar left over the drift by this method of stope preparation, and the floor pillar between the stope and the one below, are mined as one piece of ground by drilling vertical rings of holes 5 ft. apart and blasting the 5-ft. slices between successive rings one by one down on to the broken ore in the stope below, after cutting a slot through the floor pillar from wall to wall at one end to provide a free face. This slot is made 5 ft. wide to provide ample working room.

The rings are drilled as follows: Alternate rings, 10 ft. apart, to give adequate working room, are drilled at the same time, each with a Boyles JV blast-hole diamond drill. In each ring the holes, 1½ in. in diameter, are drilled from two set-ups in the drift, at specified angles to the horizontal and to specified depths, as shown in the cross-sectional drawing on this

page. Bullnose bits are used. This drilling is done by Boyles Brothers at a contract price per foot based on drilling conditions. Two men only are required, one on each drill. Footage varies from 40 to 60 ft. per drill shift. The 29 holes shown total 756 ft.

The holes in each ring are loaded with 75 percent Polar Forcite gelatin in 1⅛-in. sticks and are fired simultaneously with electric blasting caps. One hundred tons is thus broken per man-shift in stope pillars. On a basis of explosive used, the breakage by ring drilling is 3 to 4 tons per pound of powder.

In the Narrower Orebodies

Where the orebody is 20 to 30 ft. wide, the mucking-machine stope is opened in one of two following ways, each having its advantages and disadvantages: In the one, the drift, 8x9 ft. as before, is put in the footwall approximately 20 to 25 ft. and parallel with the ore, and the finger drifts are driven from it through the rock into the ore at such an angle as will permit using an easy curve in the track to reach the toe of the muck pile. The fingers are then slashed out to the ore limits at drift height. Stoping can be started immediately. It is unnecessary to cut an additional horizontal lift, as in the wider orebody, because no stope pillar is required. The drift, however, and part of the fingers must be driven in rock.

An alternative method of opening a mucking machine stope where the orebody is of narrower width, say 20 to 30 ft. as in the preceding paragraph, is as follows: The drift is driven down the middle or either wall of the ore and then slashed to the ore limits, this work being guided by assays. Thus the step of silling out is omitted. The track is then shifted to the hanging-wall side, and 8x8-ft. vertical boxholes are driven at 30-ft. intervals on the footwall side. The boxholes are taken up three rounds, about 18 ft., and are then belled out at 45 deg. until they join. This procedure leaves a pillar having a top sloping at 40 to 45 deg. up to the hanging wall. This pillar must subsequently be taken out. A further disadvantage is that more time is required to get stope ore than in the preceding case. Its big advantage over the latter is that all work is done in ore.

In the narrow orebodies where orthodox shrinkage is employed, ore is loaded from chutes in the haulage drifts into 1½-ton rocker-type side-dump cars.

Recovering Ore Left in Vertical Pillars

Recovery of stope and floor pillars by ring-drilling has already been described. As mining proceeds, the question arises as to robbing the 30-ft. vertical pillars that have been left between the 150-ft. stopes. Every other pillar is solid, as previously described, those in between having each a 5x5-ft. manway in them. These pillars will be taken or left in place, according to the necessity of supporting the walls in each particular part of the mine. They have to be left in place where the stope walls show a tendency to slough and threaten undue dilution of the ore. The pillars having a manway are easily drilled with rock drills, when the need arises. The solid pillars, however, can be taken out more easily by drilling them with vertical holes with diamond drills.

No backfilling other than with development waste rock has yet been done, because practically all stopes are still being worked. It is planned to carry on systematic backfilling with gravel when the stopes are empty.

Haulage and Hoisting

Storage-battery haulage is used. Two Mancha Little Trammer locomotives pull trips of six cars each a distance varying from 200 to 500 ft. to the grizzly of the ore-pass system. This system starts at the 210 level grizzly dump, runs by a knuckle-back raise to the 360 level, where there is a control chute and a bypassing grizzly, and from these to the loading pocket and measuring box at the shaft on the 510 level, where again a control chute and a bypassing grizzly are provided.

Ore is hoisted in balanced skips, the load averaging 2.7 tons. Chairs are not employed. Men are handled in a cage

Reagent Consumption, Golden Manitou Mill

Circuit	Reagent	Place Fed	Lb. per Ton of Mill Feed	Lb. per Ton of Feed to Individual Circuit
Primary flotation	Aerofloat 31	Ball-mill feed	0.012	
	Aerofloat 208	Ball-mill feed	0.025	
	Ethyl xanthate	Stage-fed to cells	0.070	
	Pine oil	Stage-fed to cells	0.035	
Lead flotation	Sodium sulphite	Regrind feed	0.35	0 90
	Lime	Conditioner	to maintain pH of 11.4	
	Aerofloat 31	Conditioner	0.0075	0.021
	Sodium cyanide	Conditioner	0.0144	0.039
	Ethyl xanthate	#1 rougher	0.0110	0.030
	Pine oil	#1 rougher	0.0033	0.009
Zinc flotation	Copper sulphate	Cyanide tails	1.00	
	Aerofloat 208	Conditioners	0.015	
	Lime	Conditioners	to maintain pH of 10.2	
	Lime	Zinc cleaners	to maintain pH of 11.5	
	Ethyl xanthate	Stage-fed to roughers	0.05	
	Pine oil	Stage-fed to roughers	0.01	
Cyanidation	Aero cyanide	Agitators	2.6	7.0 (3.5
	Lead acetate	Agitators	0.014	0 039 NaCN)
	Zinc dust	Precipitation	0 048	0 130
Primary grinding	3 1/2" cast-iron balls	Primary mills	1 8	
Regrinding	1 1/2" cast-iron balls.....	Regrind mill	0.6	1.6

which is put on and off as needed, being hung under one of the skips.

Ore Treatment

Treatment of Golden Manitou ore by flotation concentration and cyanidation, together with the equipment used, is shown in the adjacent cut.

The classifier overflow product at 48 percent solids and 68 percent minus-200 mesh passes to the primary flotation circuit, where a concentrate is taken off at a ratio of concentration of 2.7 to 1, containing roughly 92 percent of the gold, 90 percent of the silver, and 30 percent of the zinc, most of the iron, lead, and copper. The tailings from this operation carry 70 percent of the zinc and pass on to the zinc flotation circuit (along with the cyanide tailings).

The primary flotation concentrate is reground to 90 percent minus-200 mesh and conditioned with zinc and iron depressants ahead of the lead circuit, where a concentrate is removed at a ratio of 35 to 1, carrying 40 percent of the total gold and silver and most of the lead and copper.

The lead tailings proceed to the cyanide plant, where extraction of gold and silver is effected at a solution strength of 4 lb. of KCN per ton. Solution is precipitated at the rate of 600 tons per day.

Following double filtration and washing the cyanide tailings combine with the primary flotation tailings as feed to the zinc circuit. The zinc tailings go to waste.

All sampling is done by means of automatic electric samplers. Alkalinity is controlled by a Beckman pH meter.

Over-all recoveries are: Zinc 92 percent, gold 76 percent, silver 60 percent.

Mill-reagent and grinding-ball consumption figures are given on page 77.

The zinc concentrate, running 56 percent zinc, is shipped to Metals Reserve Co., the lead concentrate, running 30 percent lead, to American Smelting & Refining Co. at East Helena, Mont. The gold-silver precipitate, running 1.5 percent gold and 75 percent silver, is shipped monthly to American Metal Co.'s refinery at Carteret, N. J.

Operating costs per ton are: Development, $0.25; mining, $1.46; milling, $1.09; marketing, $0.32, and general charges $0.62. Total $3.74.

Golden Manitou's staff, headed by Andrew Robertson, general manager, is as follows: S.A.J. Hopper, chief engineer; G. C. Dunn, mine superintendent; D. A. Livingstone, mill superintendent; J. A. Appleton, mechanical superintendent; and G. MacDonald, mill foreman.

LEGEND

CRUSHING AND GRINDING

1. 500-ton bin
2. 30x48-in. Jeffrey grizzly feeder
3. 30-in. belt conveyor
4. 36x24-in. A.C. jaw crusher
5. Dings suspended magnet
6. 5x10-ft. double-deck Dillon screen and chute
7. Surge bin, with 24x48-in. Jeffrey pan feeder
8. 4-ft. Symons standard crusher
9. 20-in. belt conveyor
10. 1000-ton fine ore bin, Hardinge Constant-Weight feeders
11. 9 ft.x48-in. Hardinge mill (300-hp. motor with V belt and spur gear) in closed circuit with 72-in. Akins classifier

11A. 22x9-in. C.I.R. vacuum pump

11B. 12x9-in. C.I.R. compressor

12. 5x5-in. SRL pump
13. Geco sampler, mill heads

PRIMARY FLOTATION

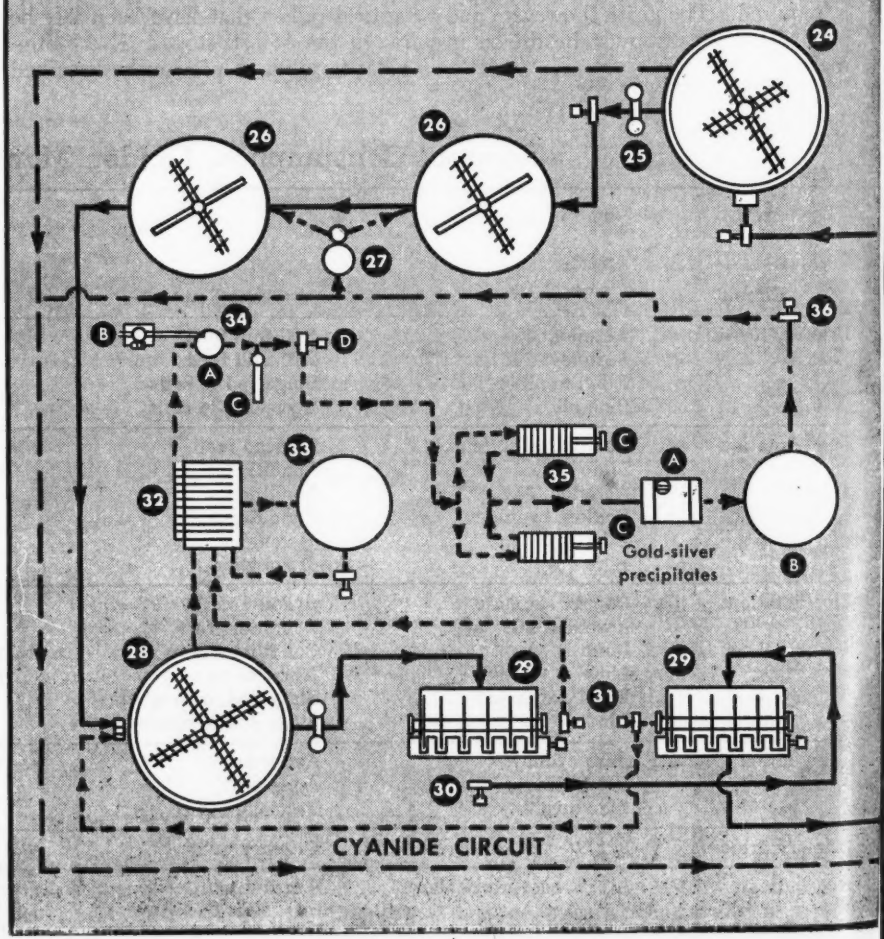
14. Primary flotation cells, No. 30 Denver
15. 600-c.f.m. blower
16. Geco sampler, primary flotation tails (to zinc circuit)

LEAD CIRCUIT

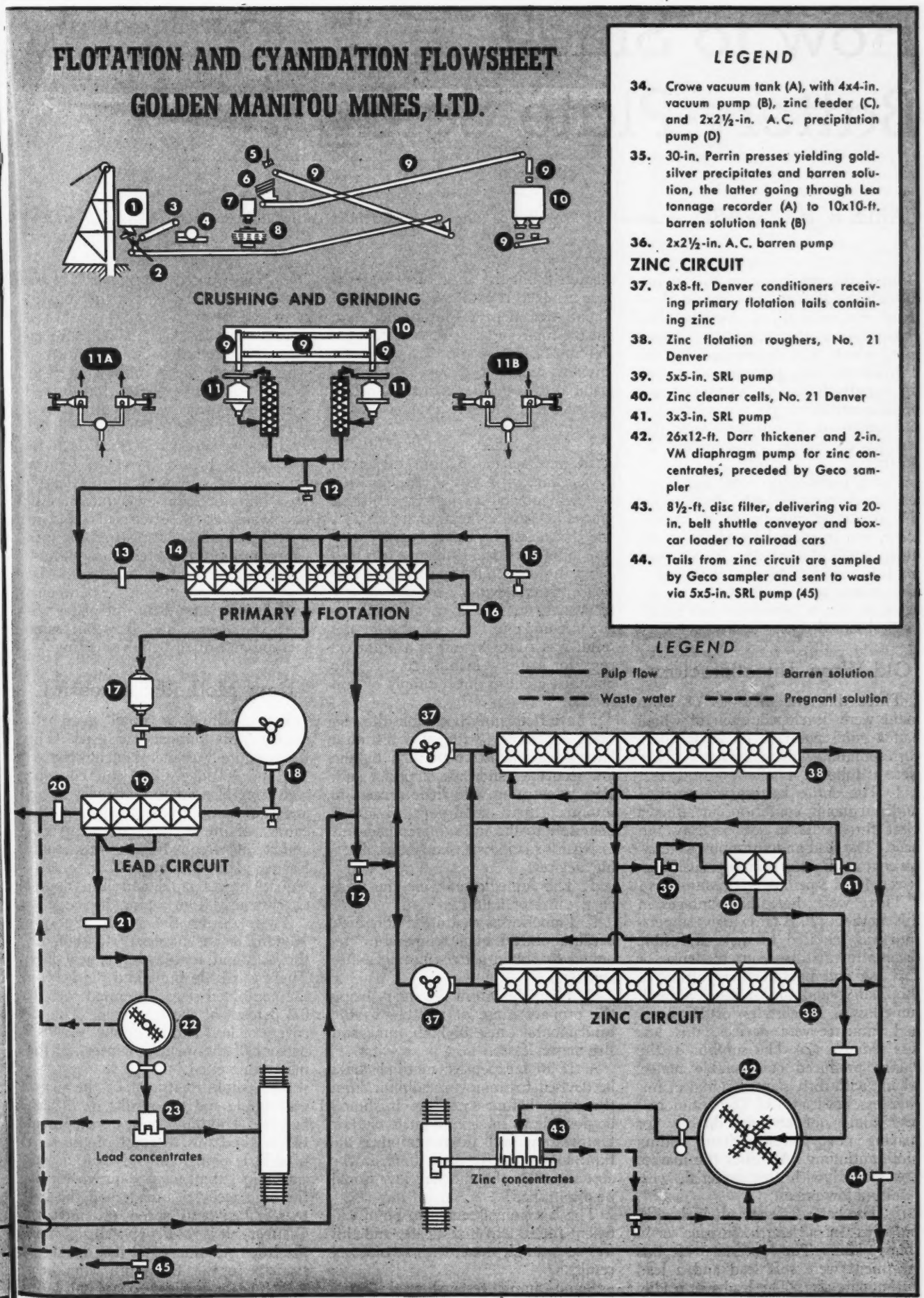
17. 6x8-ft. A.C. regrind mill (150-hp. slip-ring motor, herringbone gear) and 3x3-in. SRL pump
18. 12x12-ft. Denver conditioner, and 3x3-in. SRL pump
19. Lead flotation cells, No. 21 Denver
20. Geco sampler, lead flotation tails
21. Geco sampler, lead concentrates
22. 14x3½-ft. Dorr thickener and 2-in. VM diaphragm pump
23. 4-ft. disc filter for filtering lead concentrates before loading in cars

CYANIDE CIRCUIT

24. 31x12-ft. Dorr tray thickeners receiving lead flotation tails by 3x3-in. SRL pump
25. 6-in. Dorr VM diaphragm pump, followed by 3x3-in. SRL pump
26. 22x24-ft. Dorr agitators
27. Syntron cyanide feeder
28. 31x12-ft. Dorr tray thickener, with 6-in. VM diaphragm pump
29. 8½-ft. disc filter and repulper
30. 3x3-in. SRL pump
31. 2-in. Oliver filtrate pumps
32. 8x5-ft. clarifier, 12 leaves
33. 10x10-ft. pregnant solution tank and 2x2½-in. A.C. solution pump



FLOTATION AND CYANIDATION FLOWSHEET
GOLDEN MANITOU MINES, LTD.



LEGEND

34. Crowe vacuum tank (A), with 4x4-in. vacuum pump (B), zinc feeder (C), and 2x2½-in. A.C. precipitation pump (D)
35. 30-in. Perrin presses yielding gold-silver precipitates and barren solution, the latter going through Lea tonnage recorder (A) to 10x10-ft. barren solution tank (B)
36. 2x2½-in. A.C. barren pump

ZINC CIRCUIT

37. 8x8-ft. Denver conditioners receiving primary flotation tails containing zinc
38. Zinc flotation roughers, No. 21 Denver
39. 5x5-in. SRL pump
40. Zinc cleaner cells, No. 21 Denver
41. 3x3-in. SRL pump
42. 26x12-ft. Dorr thickener and 2-in. VM diaphragm pump for zinc concentrates, preceded by Geco sampler
43. 8½-ft. disc filter, delivering via 20-in. belt shuttle conveyor and box-car loader to railroad cars
44. Tails from zinc circuit are sampled by Geco sampler and sent to waste via 5x5-in. SRL pump (45)

How to Smelt Battery-Plate Scrap

CARLE R. HAYWARD, *Professor of Process Metallurgy, Massachusetts Institute of Technology, Cambridge*

DURING the expansion of the motor-car industry after the first World War, there was naturally a corresponding expansion in storage-battery production, which was augmented by the demand for radio batteries before the present attachment to lighting circuits became common. As a consequence, the reclaiming of lead from scrap battery plates became an important industry.

For a number of years the larger lead smelters paid little attention to the increasing importance of battery-scrap, and in every large center of industry small plants sprang up for treating this material. Most of these plants lost money and failed, however, because of lack of experience and metallurgical knowledge.

Old Ways Unsatisfactory

Three different methods of treatment were developed, each of which had a good point in its favor but a corresponding disadvantage. They were as follows:

1. The entire battery was smelted under reducing conditions in either a blast furnace or a reverberatory furnace. The lead and antimony were recovered as an alloy running usually between 4 and 5 percent antimony.

There were three disadvantages in this method. (1) A fairly high temperature was required to make a fusible slag-matte mixture from the coke or coal ash and non-metallic portion of the charge, and this resulted in high fume losses. Because few of the plants had fume-recovery devices, this loss was serious. (2) The sulphur in the charge produced considerable matte, which, with dirty slags, resulted in further losses of lead. (3) The antimonial lead could not be used directly for making new plates without adding more antimony. At times the market was glutted with this material, with resulting low prices.

2. The batteries were smelted without flux in a hearth furnace or a rotary kiln. The products of this treatment were soft lead and a lead antimonate slag. The lead was readily marketed, but the antimonial material gave trouble. It could be reduced by a second treatment to antimonial lead, but the fume and slag losses were high, and most small plants without fume catchers found it easier to sell this material to larger companies with better facilities. The net result was little or no profit.

3. The oxidized portions of the scrap were separated from the metal by mechanical means or by liquation at low temperature in kettles. This procedure gave a metal that could at once be re-used for batteries and a mixture of oxides and sulphates of lead and antimony. Smelting the latter in small plants inevitably resulted in low recoveries, so it was usually sold to larger companies. As usual, the net result was a loss instead of a profit except for battery manufacturers, who obtained a cheap direct supply of grid metal.

I have frequently been consulted by small operators with no technical knowledge who were puzzled by the low recoveries and lack of profit, and, after attempting with little success to improve their conditions, I came definitely to the following conclusions as regards plants with no fume-collecting devices.

1. The fume losses were the principal cause of failure.

2. Fume losses were inevitably high because of the high temperature required to obtain a free-running matte and slag.

3. The sulphate in the scrap, being the primary cause of matte, was the fundamental cause of both fume and slag-matte losses.

4. If an inexpensive method could be devised for removing sulphur from the scrap before smelting, it should be possible to smelt at a relatively low temperature and thus minimize the fume losses. At the same time, in the absence of matte, the slag loss would be diminished.

The last point seemed to be of sufficient interest to investigate, and this was accordingly done, with satisfactory results.

Some simple tests showed that a cold, concentrated solution of soda ash would completely remove the sulphur from the plates without loss of lead or antimony. Beaker tests with broken plates were followed by barrel tests in which whole nests of plates were dumped irregularly into iron barrels and the solution was circulated over them by an air lift. The sulphur was completely removed in three days. By first washing with water to remove free acid, the consumption of soda ash was diminished and by countercurrent circulation all the free soda was removed from the solutions and the final consumption was the chemical equivalent of the sulphur in the plates.

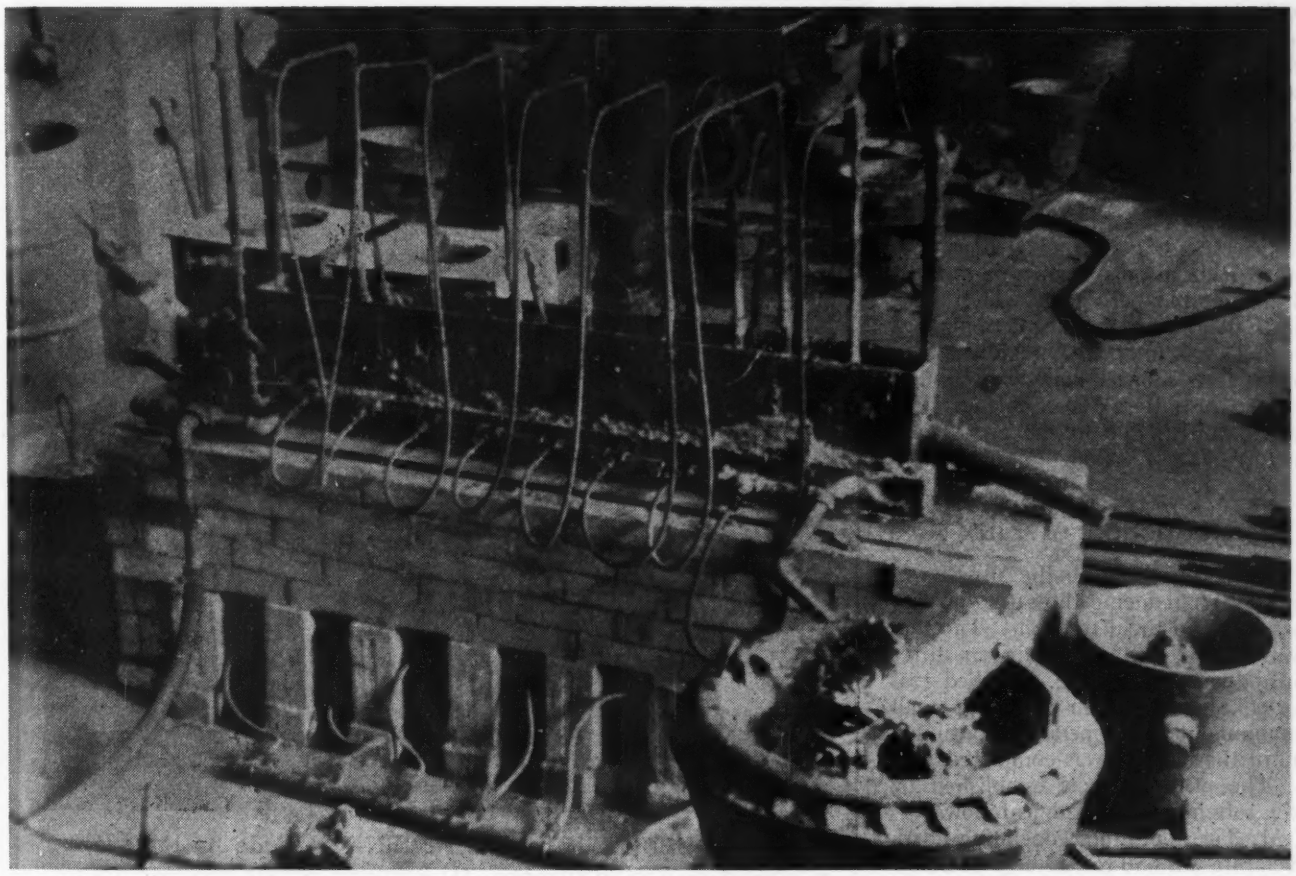
After the small-scale experiments were completed, 10 tons of plates was leached successfully by the same method and dried before smelting.

New Method Successful

For smelting, a small deep-bath reverberatory furnace was used. The temperature was maintained between 800 and 900 deg. C. A flux covering consisting of a mixture of soda, borax, and fluorspar was maintained on the surface of the charge and to this was added at frequent intervals some leached plates and fine anthracite. The reduction was rapid and lead flowed continuously from a pipe discharge.

Twice during the smelting of the 10 tons it was necessary to skim off the slag and replace it by new flux. There was little fume and the lead in the combined slags amounted to only 0.2 percent of the total lead. The recovery of lead and antimony was 98.5 percent of the metallic content of the material smelted.

The whole treatment of the plates was simple and the results were satisfactory. The only serious criticism of the method was the cost of the soda used in leaching, and this is to a considerable extent compensated for in the high recoveries made and the low temperature and speed of smelting. Glauber salt is readily crystallized from the leach solutions, and if a market is available for this, the return would help to defray the original cost of the soda.



TROUGH-TYPE SOFTENING FURNACE built to embody the countercurrent idea. View shows lead discharge pipe at left, flux discharge pipe at right, air-blowing pipes at top, and gas burners at bottom for heating. Cooling jacket extends along side of container just above the brick heating chamber

Since this process was worked out, the treatment of scrap battery plates has been almost completely taken over by large plants, where they are smelted along with other scrap materials. Because these plants have adequate facilities for collecting fume and cleaning slag, and thus can operate at a profit, they would have little interest in treating the plates to remove the sulphates. However, if there are small plants whose raw material is principally battery plates, the preliminary treatment is recommended in order to eliminate smelting difficulties.

Softening

In a previous paragraph it has been pointed out that the product from complete smelting of battery plates is sometimes not readily marketed. This may be true even when there is a ready market for soft lead and for antimony. This fact led me to a series of softening experiments that lasted many years and produced some interesting results, only a part of which, for lack of space, will be included in this paper.

The objective of the experiments was to develop a process with the following characteristics: (1) the operation to be carried out at such a temperature that steel could be used as a container; (2) the flux to absorb the antimony, but little or no lead; (3) the spent flux to be fused with carbon to reduce the antimony to metal and simultaneously regenerate the flux for re-use.

It was obvious that the first step must be to develop a flux that would be fusible at a low temperature and form a compound with antimony. It seemed equally obvious that the basis of such a flux would be sodium carbonate, but this material alone had too high a melting point.

After studying available equilibrium diagrams to obtain a basis for experimentation, it was decided to make a series of tests using mixtures of sodium and potassium carbonates with borax and fluorspar.

Several mixtures had low melting points and fluidities, but the most practical seemed to be a mixture containing by weight 4 parts of soda, 3 parts of potash, 2 parts of borax, and 1 part of fluorspar. This mixture was liquid at about 600 deg. C. and poured readily at 650 deg. C.

The containers used for most of the early work were made of 1-ft. lengths of double-thick steel pipe or Shelby tubing 4 in. in diameter with a welded steel bottom. Some cast-iron containers of about the same size were used, but they lost their shape and were otherwise less satisfactory. These were heated in a small gas furnace having four peripheral jets which swirled the flame around the pot.

Flux Ratio Important

The standard weight of antimonial lead used in the early tests was 5 kg., and after some preliminary tests, it was decided to use 1 kg. of flux with this amount of metal. The flux was used on three successive lots of lead before it was reduced. This method gave more satisfactory results than were obtained when using smaller amounts of flux in single treatments.

The operating procedure was to melt flux and lead and then insert a ¼-in. steel pipe for air oxidation. It usually took slightly over an hour to soften 5 kg. of lead, after which the contents of the pot were poured into a mold and, after cooling, the flux was broken off for use on a new lot of lead. After the third use, it was crushed, mixed

with fine coal, coke, or charcoal, and heated until reaction ceased. The charge was then poured in a mold and cooled. The products were antimonial lead and regenerated flux; the latter was available for re-use.

Scores of tests were made using the small pots with 5-kg. charges of lead. Later larger pots using 10 to 15 kg. of lead were used, and finally some tests were made in pots capable of treating 1 ton of lead per charge. The larger tests confirmed the results obtained in the small tests, and in addition the 1-ton tests showed that during much of the operation no extraneous heat was required, due to the exothermic nature of the reaction.

Reduction of Flux

A modification of the usual procedure for reducing the saturated flux was tried in the 1-ton tests. The flux was melted and a motor-driven stirrer introduced from above. Crushed coal or coke was added in successive small amounts and the operation continued until the reaction was completed.

The principal facts established by the softening tests were as follows:

1. The optimum operating temperature was 680 to 720 deg. C. Below 680 deg. the softening operation was slow and above 720 deg. the deterioration of the pot and blowing tubes was excessive. If operated above 750 deg. the latter was particularly noticeable.

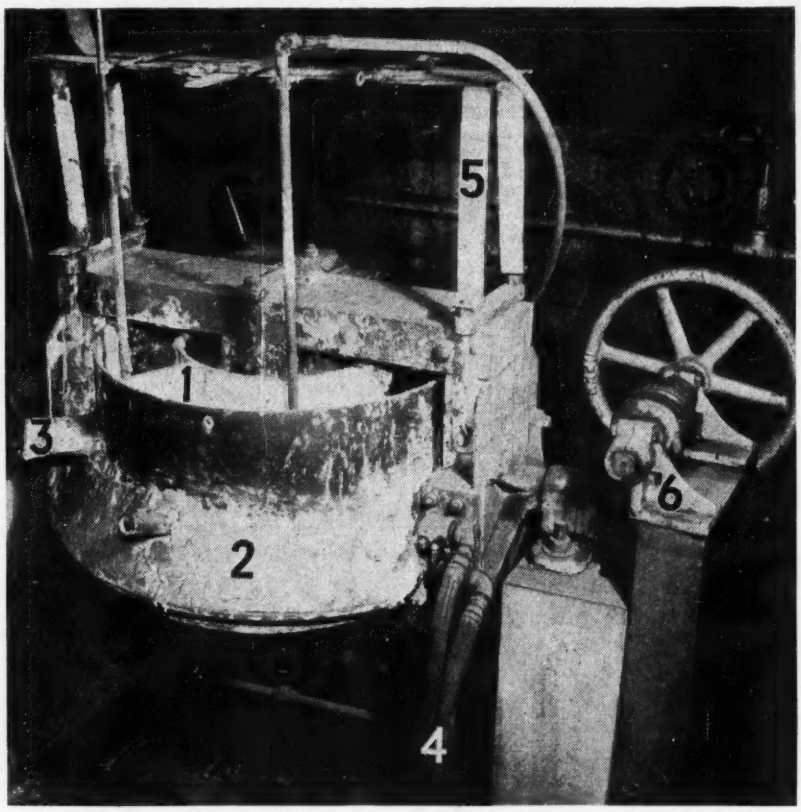
2. The flux could be re-used many times successfully, but it gradually became sticky after successive reductions and required high temperatures for fluidity. In one series of tests 200 kg. of 4.5 percent antimonial lead were softened in 5-kg. lots by using an initial lot of 1 kg. of flux, which was successively regenerated and re-used until it was no longer sufficiently fluid.

3. The usual antimonial lead obtained from reducing the flux contained 40 to 50 percent antimony, but if the slag from three softening tests were poured on a fresh lot of antimonial lead and stirred for a few minutes, then removed and reduced, the antimonial lead product was about 80 percent antimony. A 98 percent antimonial product was made by agitating normal saturated flux on 40 percent antimonial lead, and then removing and reducing it.

4. By mixing nitre with the charge the rate of softening may be increased, or nitre may be used as a substitute for air oxidation.

5. As the antimony oxidizes and enters the flux, the fluidity of the latter increases.

6. If tin is present in the lead to be softened, it oxidizes before the antimony and tends to make the flux sticky; but if the blowing is continued until the antimony oxidizes, the flux again becomes fluid.



LOW-FREQUENCY INDUCTION FURNACE made by remodeling a laboratory Kjellin furnace. (1) Partition across annular trough. (2) Lead discharge. (3) Flux discharge. (4) Water-cooling pipes for primary winding. This winding around the center core consists of copper tubing through which water flows. (5) Frame for supporting blowing pipes. Only two pipes are in place. (6) Device for tilting the furnace to empty it

The fundamental tests just described seemed to show that the method was practical, so it was next decided to try it as a continuous countercurrent process. For this purpose six pots 5 in. in diameter and 12 in. high were joined in line by 2-in. pipes 2 in. long, welded so as to give a continuous passage from pot to pot 7 in. above the bottom. An overflow pipe for slag discharge was inserted in one of the end pots 2 in. higher than the connecting pipes. The pot at the opposite end was fitted with a lead discharge pipe sloping upward from the bottom and terminating at a point just below the level of the slag discharge. The whole assembly was then inserted in an oblong gas-fired heating chamber and the middle four pots equipped with blowing pipes.

Lead was added until it filled all the pots and overflowed from the discharge pipe; then flux was added until it overflowed from the flux spout. Blowing was then started and lead added at frequent intervals to the pot from which the flux discharged, and simultaneously flux was added at the opposite end.

Some mechanical difficulties developed in this arrangement, but enough data were obtained to indicate that the countercurrent idea was feasible, so a different form of apparatus was built. A view of the improved equipment is shown on page 81. It was made of $\frac{5}{16}$-in. steel in the form of a rectangular box with a V-shaped bottom with welded joints. It was 5 ft. long, 5 in. wide, and 20 in. high, and had 10 steel baffles welded at equal intervals across the interior. These baffles had 2-in. slots at the center extending down to within 8 in. of the bottom. The lower part of the chamber was thus divided into 11 compartments 8 in. deep, and the upper part

into similar compartments with restricted connections. From one end compartment there was an overflow spout for flux discharge, and from the bottom of the compartment, at the other end, a lead discharge pipe sloped upward to a point just above the level of the slots in the interior partitions.

Along the sides at the lead level a water jacket was provided to protect the slag line from corrosion.

The equipment was surrounded by a brick heating chamber extending to the water jacket and heated with gas. Blowing pipes were introduced into all the compartments of the container except those at the ends.

This softening equipment operated much better than the line of pots previously used. The water jacket gave too much chilling, but when air was substituted for water the operation was satisfactory. Hard lead was fed continuously at one end and new flux at the other, and soft lead and saturated flux were obtained as products of countercurrent flow.

Furnace Corrosion

On the basis of the results obtained in this work, a much larger unit of similar design was set up at a commercial lead refinery and operated for about a month. The usual difficulties which arise in pilot-plant work were encountered, but the general practicability of the method was established.

It was found, however, that corrosion of the steel, which seemed negligible in carefully controlled small-scale operation, was more serious in the pilot-plant equipment. Several breakouts occurred, so for this and other reasons the work was stopped.

Further work has since been done on a laboratory scale to overcome the corrosion of the container. If the bath is to be maintained at 680 to 720 deg. C., it is obvious that the steel containers must be heated to a considerably higher temperature. This results in serious scaling on the outside and corrosion at the slag line on the inside. The former could be overcome by using heat-resistant steel, but this steel will not resist interior corrosion.

The solution of the problem was found by remodeling a laboratory Kjellin furnace. This is a low-frequency, ring-type induction furnace with a graphite hearth used for melting cast iron. The hearth was removed and replaced by one made of $\frac{5}{16}$-in. steel. A picture of the remodeled equipment is shown on page 82. It consisted of a welded annular trough 5½ in. wide, 26½ in. in outside circumference, and 12 in. deep. A partition was welded across the trough at a convenient point. At one side of this partition was an overflow trough for saturated flux and on the other a discharge spout for soft lead. Blowing pipes were placed at five points. The general arrangement was therefore the same as in the straight trough used in earlier laboratory tests. The principal differences were that no baffles were provided and the trough was circular and flat bottomed instead of straight with a V-shaped bottom.

Heating was provided by low-frequency electric induction whereby the secondary current passed in part through the container and in part through the lead. Agitation of the charge heated the non-conducting flux by mixing it with the hot lead. By regulating the rate of feeding hard lead, near the flux discharge trough, and flux near the lead discharge spout, it was found possible to obtain satisfactory continuous softening of the lead. The flux discharged while the furnace was working normally, gave on reduction an antimonial lead which analyzed between 75 and 80 percent antimony.

It should be noted that whereas in an externally-heated vessel the steel is always necessarily hotter than the charge, the reverse condition holds in the induction furnace. In fact, a crust of flux attaches itself to the inside of the shell and protects it from corrosion. The lower half of the container was insulated with asbestos-magnesia pipe covering.

Before using this equipment for softening, its capacity as a lead-melting device was determined. After it was filled with melted lead at the melting point, it was found that 1,925 lb. of pig lead per hour could be charged with continual overflow. The power requirements were 21 kw-hr. per ton of lead. With a longer unit and better insulation the power consumption could undoubtedly be greatly reduced, which raises the question as to the possible utility of induction furnace melting in the lead industry.

In operating the induction furnace as a softening unit, the capacity is considerably less than when used as a melting unit, because of the higher temperature and the time required for the softening reactions to take place. The principal difficulties encountered were due to the fact that the flux was not a conductor and was therefore not heated directly by the current. A fair degree of liquidity was obtained, however, through mixing hot metal and flux by the air used for oxidation. It is believed that with a larger unit having a wider trough equipped with an insulating cover, the increased amount of heat stored in the metallic charge will aid in overcoming these difficulties. It is also believed that if lead and flux are added molten instead of solid, more favorable conditions would prevail.

In spite of difficulties it was found possible to operate the unit as a continuous softening device. Little deterioration of the container was noticed. This type of equipment could be built to operate in units of 25 to 50 tons' daily capacity. It is doubtful if larger units would be satisfactory for use with low-frequency currents.

Continuous Reduction of Flux

In order that the whole process might be continuous, some experiments were made to develop a continuous-reduction process for recovering the antimony and regenerating the flux. For this purpose a welded rectangular steel box was lined with magnesite brick on sides and bottom, leaving a space 40 in. long, 8.5 in. wide, and 13.75 in. deep. This space was covered with firebrick tile. At one end was an opening for an oil or gas burner and at the other a spout for discharging reduced slag. The reduced lead was removed through a sloping pipe welded to the shell with one end terminating on the inside near the bottom of the hearth and the other on the outside, 4 in. higher.

The furnace was first heated and lead charged until it began to flow from the discharge spout. The saturated flux, crushed to pass a 4-mesh screen, and mixed with 7 percent coal, was fed through the top near the firing end. By regulating the rate of charging, it was found that a continuous flow of reduced flux was obtained from the discharge spout and a continuous flow of antimonial lead came from the siphon tap.

In practice it should be feasible to arrange the reducing furnace so that the regenerated flux would flow directly from the reducing furnace to the softening unit. There has been no opportunity to carry the electric furnace softening and the continuous reduction beyond the laboratory stage, but there seems to be no reason why larger units should not be more successful than the small units thus far used.

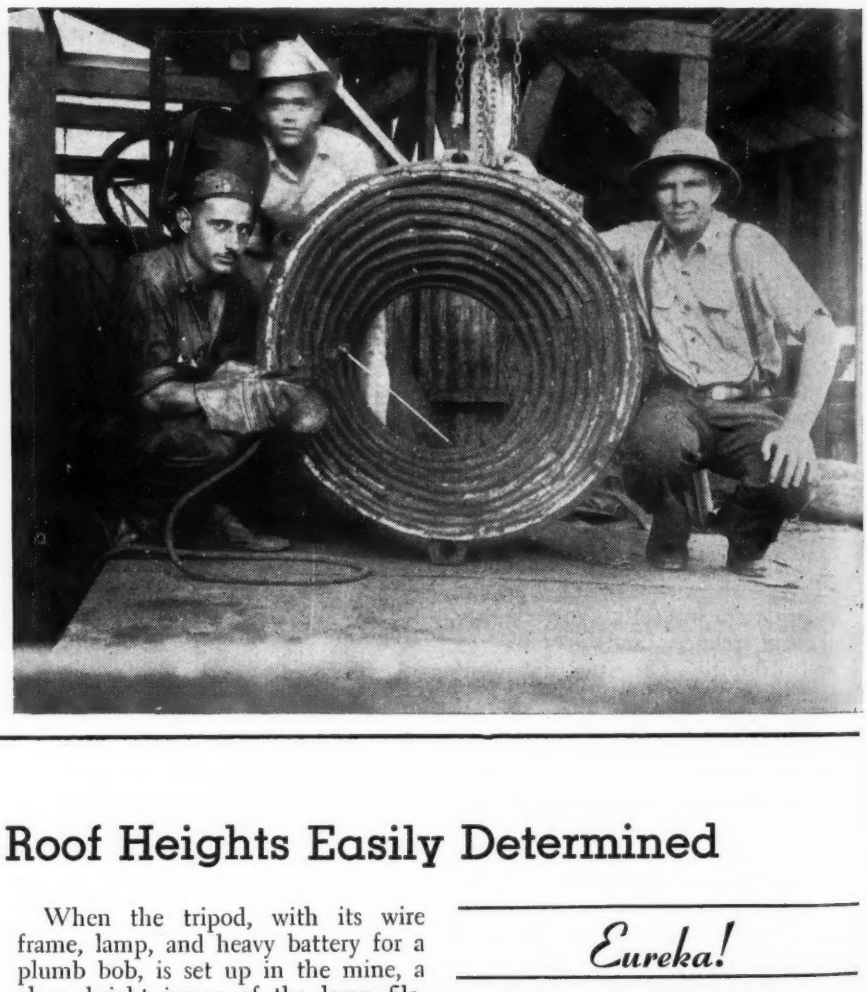
Special acknowledgment should be made of the constant help of Robert B. Lovely, as well as the assistance of George P. Swift, Edward M. Fischer, Albert V. Finn, Carl W. Schwenzfeier, and Stanley M. Baxter. The cooperation of the United States Metals Refining Co. in the large-scale tests is also appreciated.

OPERATING IDEAS

Drill Steel Used to Line Bowl of Cone Crusher

DIFFICULTY of obtaining new steel to replace the worn bowl liners of a 3-ft. Symons cone crusher led W. A. Vickers, master mechanic of Neptune Gold Mining Co., Bonanza, Nicaragua, to work out the method the results of which are shown in the accompanying photograph. Old drill steel, cut into 14-in. lengths, was used as the lining material. In placing them, each piece was heated red hot in a charcoal fire, tack-welded to the bowl at one end, then hammered down into place and welded in securely. The pieces were of $\frac{7}{8}$-in. and 1-in. octagon steel, and about 20 lb. of electrodes was used in each relining operation.

This drill-steel liner gave about half the service of the regular liner, and in practice it was found that a finer-crushed product was obtained if the steel pieces were placed as close together as possible. Shown in the photo are, from left to right, Senario Filipone, welder; Oliver Maronez, drill repairman; and Mr. Vickers.



Open Stope Roof Heights Easily Determined

ROOF HEIGHTS in the room-and-pillar mine of the Jefferson Island Salt Mining Co., Jefferson Island, La., are quickly and accurately measured by sighting with a transit on the image of a cap lamp filament projected on the roof of the stope. The method is used and was reported by Glenn T. Duvall, engineer with the company.

A wire frame was constructed to hold an Edison cap lamp with the battery in the bottom. Two of the wires were extended upward about 3 ft. and were then bent outward for hanger ears to support the lamp by resting on the flat ring of an open-ring tripod. The lamp was fixed to a plate soldered between the wires above the battery in such a way that the beam of the light shone vertically upward. An open flat ring was then soldered between the wires at a point $8\frac{1}{8}$ in. above the lamp. This distance is the focal length of a two-power reading glass, $2\frac{3}{4}$ in. in diamater, and the ring was provided as a support for the lens.

When the tripod, with its wire frame, lamp, and heavy battery for a plumb bob, is set up in the mine, a clear, bright image of the lamp filament is thrown on the stope roof 65 to 80 ft. above. The lens is moved horizontally on its support until trial with the transit shows the image to be vertically above the lens, which is then taped in that position.

The transit is set up on a previously located station with a known backsight, preferably within 100 ft. of the lamp tripod. Height of the lens above the floor is measured, and distance from the instrument to the lens is taped. Vertical angles to the roof spot and to the lens and the horizontal angle are then read. The customary calculations will then give the roof height. The elevations may be plotted on the map because the horizontal angle was read and the distance calculated. Check heights from 20 to 80 ft. show less than 0.8 ft. error at the larger distance.

Eureka!

Leaping from his bath tub, the wise, but emotional, Archimedes rushed into the streets of Syracuse, shouting "Eureka!" This was only his way of announcing the solution of a problem that had long been puzzling him, and the tolerant citizens of Syracuse were used to it. "What a character!" they probably said, and then went on about their business.

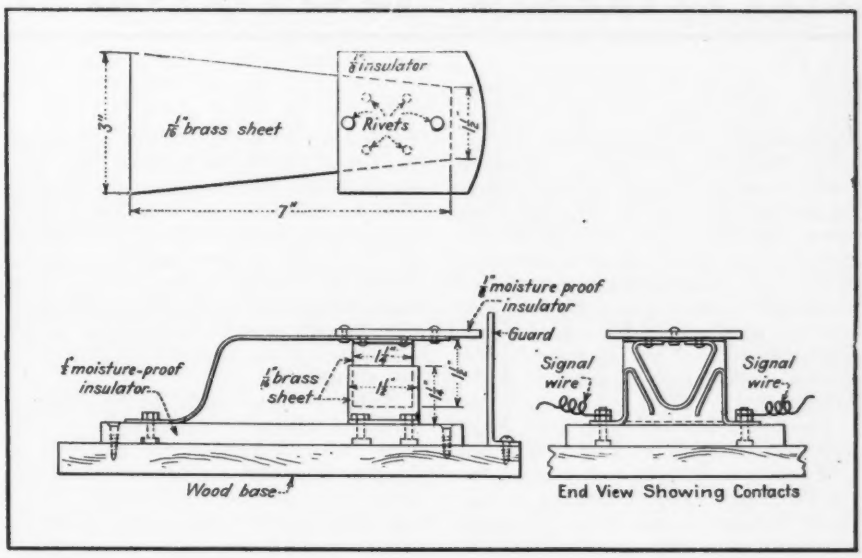
When you solve a difficult technical problem, don't go to the extreme of Archimedes' method of announcing it. On the other hand, don't hide your light altogether. Send us a description of what you did, with a sketch or snapshot if possible, and we'll see that the mining industry hears about it. E. & M. J. pays $5 for every such idea used.

Heavy-Duty Mine Signal Pushbutton

THE SIGNAL BELL in the hoisting shaft at the mine where John S. Fraser, Bienfait, Sask., Canada, is electrician is rung about 1,000 times a shift, and the pushbuttons had given a lot of trouble. Mr. Fraser writes:

"We always were experimenting with different types, with all giving the same results — about three months' service. It was then decided to design one of our own, and after some experimenting, the one shown in the sketch was installed for trial.

"Results were so favorable that I thought the idea might be of interest to others. The sketch is self-explanatory. The contacts have a good springy wiping action, and this pushbutton has not needed one service visit since it was installed."



Misaligned Motors May Cause Burnt Commutators

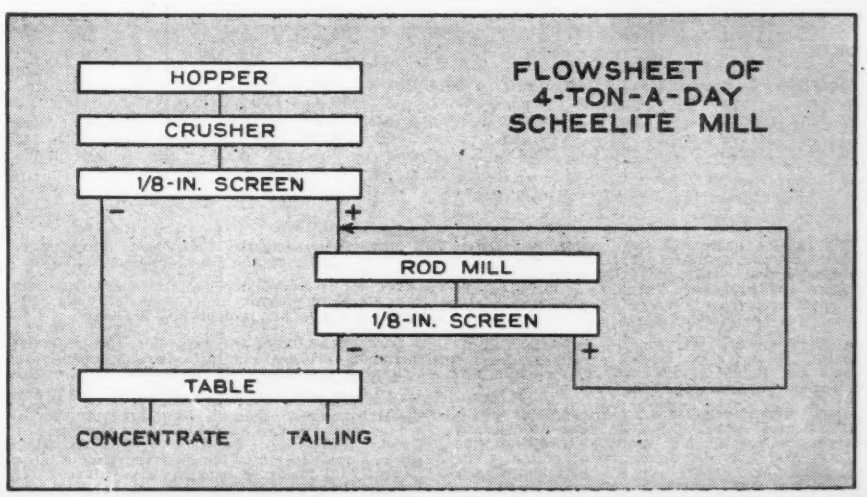
MISALIGNMENT or distortion in fixed or flexible couplings can cause motor troubles whose origin is difficult to trace, according to Lionel A. Hunt, St. Catherines, Ont. For example, a d.c. motor direct-connected to a pump was plagued with commutator burning. Careful checking for every conceivable fault showed that the motor was in perfect condition, but serious blackening of the commutator continued. At last the motor hold-down bolts were loosened while the unit was running, and a slight vibration, accompanied by a muffled knocking, was noticed. After the motor was carefully aligned and the bolts were tightened, all vibration and noise disappeared. No further burning of the commutator has occurred.

On another motor, brush chatter and frequent breaking of pigtails were traced to a slightly distorted rigid coupling. Breakage of pigtails was stopped by forming them into complete loops, and chatter was ended by replacing the coupling.

High-Grade Concentrate From Makeshift Mill

INTERESTING as an example of what can be accomplished by a combination of ingenuity and scrap materials, the "mill" whose flowsheet is shown in the accompanying sketch was built by Al Feuerstein, of Fresno, Calif., to treat a tungsten ore. He reports that he was able to mine and mill four tons of ore daily, that he produced a concentrate containing 69 percent WO_3, and that the recovery approached 60 percent. He incloses the assay report of a Fresno laboratory which shows that it purchased from him 327 lb. of scheelite concentiate, the grade of which was 69.18 percent WO_3.

The equipment in the flowsheet is as follows: The hopper is an old steel truck body; the screens and rod mill consist of an 11-ft. length of 17-in. iron pipe with a section of ⅛-in. square mesh screen attached to each end to give the effect of short sections of trommel screen; inside the pipe are placed four 7-ft. iron rods, weighing 460 lb. each, for the purpose of grinding the ore. Material passing these screens flows to a table. The pipe "rod mill-screen" is mounted on a large pipe lathe, the cutting head of which has been removed to furnish space for mounting the crusher. All the equipment, plus an air compressor and a light plant, is driven by a Ford Model A engine.



MARKET SUMMARY

DEMAND FOR COPPER AND ZINC increased during February, contrary to expectations, owing to an expansion in the brass program for artillery requirements. Buying of lead was in sufficient volume to absorb domestic output plus a fair tonnage of foreign metal. WPB asked for increased output of sheet aluminum to meet special aircraft needs, but this development left the aluminum ingot situation about unchanged. Magnesium production is expected to decline in volume.

Quicksilver prices became more or less stabilized at $130 per flask, New York. The decline in the price that occurred since the beginning of 1944 was viewed by many in the industry as too drastic, yet buying remained light, with consumers looking for evidence on the extent that production has been curtailed. At $130 per flask, producers believe that output in this country should drop to the rate of 33,000 flasks a year. Production in 1943 was estimated at 53,500 flasks. Mexican producers are distressed about the reduction in the price level, because on sales to the United States they have to consider the Mexican export tax as well as the import duty exacted by this country.

Sales of copper made during February point to deliveries of more than 150,000 tons during March. Actual deliveries in January amounted to only 101,586 tons, according to the Copper Institute. February deliveries, to be divulged soon, absorbed domestic output and a fair tonnage of foreign origin metal, the trade believes. The improved outlook for copper caused WPB to issue an appeal to industry and labor for full production for 1944.

The extent to which Rhodesian production of copper is to be curtailed has not yet been settled, the Combined Raw Materials Board announced on Feb. 10. Uncertainties of future production and military requirements are such that the United Nations should proceed cautiously with any program to reduce output, members of the Board stated. They admitted, however, that the United Nations' copper position has improved in recent months.

Production of slab zinc in the United States during January amounted to 84,066 tons, with deliveries of 63,421 tons, the

Major Metals

U.S. DAILY AND AVERAGE PRICES

1944 Feb.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	11.775	11.700	52.000	6.50	6.35	8.25
2	11.775	11.700	52.000	6.50	6.35	8.25
3	11.775	11.700	52.000	6.50	6.35	8.25
4	11.775	11.700	52.000	6.50	6.35	8.25
5	11.775	11.700	52.000	6.50	6.35	8.25
7	11.775	11.700	52.000	6.50	6.35	8.25
8	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
10	11.775	11.700	52.000	6.50	6.35	8.25
11	11.775	11.700	52.000	6.50	6.35	8.25
12	Holiday	11.700	Holiday			
14	11.775	11.700	52.000	6.50	6.35	8.25
15	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
17	11.775	11.700	52.000	6.50	6.35	8.25
18	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
21	11.775	11.700	52.000	6.50	6.35	8.25
22	Holiday	11.700	Holiday			
23	11.775	11.700	52.000	6.50	6.35	8.25
24	11.775	11.700	52.000	6.50	6.35	8.25
25	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25
28	11.775	11.700	52.000	6.50	6.35	8.25
29	11.775	11.700	52.000	6.50	6.35	8.25
			AVERAGES FOR MONTH			
Feb.	11.775	11.700	52.000	6.50	6.35	8.25
			AVERAGES FOR WEEK			
Feb.						
2	11.775	11.700	52.000	6.50	6.35	8.25
9	11.775	11.700	52.000	6.50	6.35	8.25
16	11.775	11.700	52.000	6.50	6.35	8.25
23	11.775	11.700	52.000	6.50	6.35	8.25
			CALENDAR WEEK AVERAGES			
Feb.						
5	11.775	11.700	52.000	6.50	6.35	8.25
12	11.775	11.700	52.000	6.50	6.35	8.25
19	11.775	11.700	52.000	6.50	6.35	8.25
26	11.775	11.700	52.000	6.50	6.35	8.25

Gold, Silver, Sterling

DAILY AND AVERAGE PRICES

1944 Feb.	Sterling Exchange: "Checks" (Nominal)	Sterling Exchange: "90-day demand"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	401.000	(f)	44.750	23.500	168s	$35.00
2	401.000	(f)	44.750	23.500	168s	35.00
3	401.000	(f)	44.750	23.500	168s	35.00
4	401.000	(f)	44.750	23.500	168s	35.00
5	401.000	(f)	(e)	(e)	(e)	35.00
7	401,000	(f)	44.750	23.500	168s	35.00
8	401.000	(f)	44.750	23.500	168s	35.00
9	401.000	(f)	44.750	23.500	168s	35.00
10	401.000	(f)	44.750	23.500	168s	35.00
11	401.000	(f)	44.750	23.500	168s	35.00
12	Holiday	Holiday	(e)	(e)	(e)	Holiday
14	401.000	(f)	44.750	23.500	168s	35.00
15	401.000	(f)	44.750	23.500	168s	35.00
16	401.000	(f)	44.750	23.500	168s	35.00
17	401.000	(f)	44.750	23.500	168s	35.00
18	401.000	(f)	44.750	23.500	168s	35.00
19	401.000	(f)	(e)	(e)	(e)	35.00
21	401.000	(f)	44.750	23.500	168s	35.00
22	Holiday	Holiday	Holiday	23.500	168s	Holiday
23	401.000	(f)	44.750	23.500	168s	35.00
24	401.000	(f)	44.750	23.500	168s	35.00
25	401.000	(f)	44.750	23.500	168s	35.00
26	401.000	(f)	(e)	(e)	(e)	35.00
28	401.000	(f)	44.750	23.500	168s	35.00
29	401.000	(f)	44.750	23.500	168s	35.00
			AVERAGES FOR MONTH			
Feb.	401.000	.....	44.750	23.500	....	35.00
			AVERAGES FOR WEEK			
Feb.						
2	401.000	.....	44.750	.....	....	.....
9	401.000	.....	44.750	.....	....	.....
16	401.000	.....	44.750	.....	....	.....
23	401.000	.....	44.750	.....	....	.....

Calendar week averages, New York Silver: Feb. 5th, 44.750; 12th, 44.750; 19th, 44.750; 26th, 44.750.
(e) Not quoted (Saturday). (f) No quotations.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Owing to the World War and the disruption of normal trade relations, our export copper quotations, since September, 1939, have been based largely on f.a.s. transactions, ex United States ports. We deduct .05c. from the f.a.s. basis (lighterage, etc.) to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries: tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal*'s average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotations on newly-mined domestic silver, 999 fine was 70⅝c. throughout February.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

American Zinc Institute reports. Stocks of zinc concentrate in this country at the end of 1943 contained the equivalent of 352,000 tons of zinc, according to WPB. Total supply of zinc concentrate for last year was 1,193,200 tons of zinc contained.

To meet total needs for lead during February, Metals Reserve Co. released around 8,000 tons of foreign metal to domestic consumers.

The British authorities raised the price of 99 percent tin in the English market £25 per long ton, establishing the base at £300. The higher selling price became effective Jan. 1. The tin situation in the United States remains about unchanged, despite political tension in Bolivia. Weather conditions hampered the movement of tin concentrate during February.

Current consumption of manganese ore is at the rate of 1,400,000 tons a year, with chrome ore requirements estimated at 900,000 tons, the Ferro-Alloys Branch of WPB revealed. The annual rate of consumption of molybdenum was estimated at 53,825,000 lb.; tungsten 17,151,000 lb.; and vanadium 3,672,000 lb.

Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for January and February.

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

	Jan.	Feb.
Quicksilver, N. Y. flask.	151.600	130.000
Antimony (a)	15.839	15.839
Antimony, bulk, Laredo.	14.500	14.500
Antimony, bulk, N. Y.	15.265	15.265
Antimony, Chinese (b).	16.500	16.500
Platinum, oz. troy	35.000	35.000
Cadmium (c)	90.000	90.000
Cadmium (d)	92.500	92.500
Cadmium (e)	95.000	95.000
Aluminum, ingot	15.000	15.000

E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

1929	110.33	1936	73.45
1930	82.87	1937	90.86
1931	60.20	1938	73.67
1932	48.26	1939	77.71
1933	59.79	1940	79.22
1934	69.59	1941	83.49
1935	74.66	1942	86.80
	1943	88.74	

	1942	1943	1944
January	85.39	88.74	88.74
February	85.90	88.74	88.74
March	85.90	88.74	....
April	85.90	88.74	....
May	85.90	88.74	....
June	85.90	88.74	....
July	85.90	88.74	....
August	85.90	88.74	....
September	88.74	88.74	....
October	88.74	88.74	....
November	88.74	88.74	....
December	88.74	88.74	....

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

(March 1, 1944)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	15c
Antimony, domestic, spot, lb. 5 tons or more	15.839c.
Bismuth, ton lots, lb	$1.25
Cadmium, commercial sticks, lb	90c.
Calcium, lb., ton lots 97 @ 98 per cent	$1.25
Chromium, 97 per cent grade, lb	89c.
Cobalt, 97 to 99 per cent, per lb	$1.50
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carloads, lb	20½c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$35.00
Quicksilver, flask of 76 lb., 100 flasks or more	$130.00@$135.00
Radium, mg. radium conten	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, carloads, lb	14.75c.
Tellurium lb	$1.75
Thallium, 100 lb. or more, lb	$10.00
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, 10 to 12% BeO, f.o.b. mines, ton	(b)$100.00@$120.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry, 48% Cr_2O_3, 2.8 to 1 ratio	$41.00
48% Cr_2O_3, 3 to 1 ratio	$43.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$4.75
Mesabi bessemer	$4.60
Old Range non-bessemer	$4.60
Mesabi, non-bessemer	$4.45
Lead (Galena) 80 per cent, Joplin, Mo., ton	$76.54
Manganese (dutiable) f.o.b. cars Atl. ports, long ton unit Mn:	
50 per cent	79.8c.
48 per cent	78.8c.
46 per cent	76.8c.
Manganese Ore, domestic, 48%, f.o.b. MRC depot, l.t. unit	$1.00
Molybdenum Ore, 90%, per lb. of MoS_2, f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	(b) $24.00
Domestic, 65 per cent and upward	(a) $26.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27.50c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$55.28

(a) Prices at mines, small lots, usually several dollars less. (b) Nominal

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	4c.
Cobalt Oxide, 70 @ 71 per cent, lb	$1.84
Copper Sulphate, 100 lb	$5.00

ALLOYS

Beryllium Copper, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent per pound of Cr contained	13c.
Ferromanganese, 78 @ 82 per cent, gross ton	$135.00
Ferromolybdenum 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, per lb. of contained Si	6.65@8.10
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.90
Ferrovanadium, per lb. of V, delivered	$2.70@$2.90
Silicomanganese, 1 per cent C, gross ton	$133.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canadian (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$650@$750
Crude No. 2	$165@$385
Spinning fibers	$124@$233
Paper stock	$44@$49.50
Shorts	$14.50@$26.50
Vermont, f.o.b. Hyde Park:	
Shingle stock	$62.50@$65.00
Paper stock	$44.00@$53.00
Shorts	$14.50@$28.50
Floats	$19.50
Barytes, long ton:	
Georgia, crude	$8.50@9.00
Missouri, 93 per cent $BaSO_4$, less than 1 per cent iron	$6.75@$7.25
Bauxite, long ton:	
Domestic, crude, 50 @ 52 per cent (not dried)	$5.00
Domestic, chemical, 55 @ 58 per cent	$7.50@$8.50
Domestic, abrasive, 80 @ 84 per cent	$16.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$15.00
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85-5 per cent, all rail movement, ton	$33.00
Acid 98 and 1 per cent, bulk, ton	$37.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$22.00
Mica—Base prices on sheet, North Carolina one-half trim, as posted by the Colonial Mica Corp., the Government's buying agency for obtaining strategic mica, per pound, follow: Sheet to cut minimum of 1½ × 2 in. $2.40; 2 × 2 in. $3.52; 2 × 3 in. $4.64; 3 × 3 in $5.12; 3 × 4 in. $6.08; 3 × 5 in. $7.04; 4 × 6 in. $8.00; 6 × 8 in $9.12; punch, 30c. Premium and discounts up to 40 per cent, depending on quality and trim. Scale does not apply to non-strategic mica	
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12c., nom
Silica, in bags, 325 mesh, ton	$20.00@$40.00
Sulphur, Texas, mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York double air-floated, 325 mesh	$12.00@$15.00
Vermont, extra white, 200 mesh	$9.50@$10.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$23.50
Steel, base prices, Pittsburgh Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10

WASHINGTON REFLECTIONS

McGRAW-HILL WASHINGTON NEWS BUREAU

Baruch Submits Sane Reconversion Report

How the country is to make an orderly conversion from the wartime economy to peacetime pursuits is bothering Washington as much as speculation about the second front. Release of the Baruch-Hancock report on demobilization of industry in mid-February caused added attention to postwar matters.

WPB Chairman Donald Nelson started the ball rolling by outlining the problems as he saw them for a number of the industry advisory committees. In doing so he warned against the overoptimistic idea that reconversion could be started at once because of the easier position of material supplies. Mr. Nelson outlined the basis for discussion of the problems of demobilization of industry as follows:

"1. There can be no immediate general resumption of the manufacture of consumer goods, because military programs still have first call on the nation's resources, and neither manpower, manufacturing facilities, nor component parts for large-scale consumer goods production are now available.

"2. Nevertheless, it is essential to make plans now so that when the proper time does come the transition from a war economy to peacetime production is as smooth, as rapid, and as fair as possible.

"3. Collection of facts and full, frank discussion with industry and labor of the difficult problems involved is a necessary part of such planning."

As materials and labor become available, the question arises as to what firms are to be allowed to return to peacetime production on a basis that is fair to other firms in the same industry which may have continuing war contracts.

The complexity of the problems grows the longer they are considered. The successful solution is of intense interest to the mining industry, since the wrong solution or no solution, which happened in the last war, will have immediate and adverse effect on the metal markets.

Opposition to the Baruch-Hancock plan for the demobilization of business developed in Washington as soon as the report had been submitted. Congressional leaders working on their own plans were quick to point out faults, real or imagined. Comparisons of the Baruch-Hancock report on war and postwar adjustment policies and other plans such as that of the Senate Postwar Planning Committee headed by Senator George will fill the newspapers for many a day. Basic issue, according to Senator George, is whether Executive directives or Congressional legislation shall establish the country's economic policies.

The Baruch-Hancock report recommends that no separate agency be set up to handle the problems of industrial changeover from war to peacetime operation.

"The agencies that did the mobilizing will have to carry out their comparable tasks in the demobilizing. At the present stage of the war, preparations for demobilization are inseparable from the actual conduct of the war, from the constant adjustments required by the war. For this chief reason, we are opposed to the creation of a new, separate Office of Demobilization.

"Such an agency could hardly avoid coming in conflict with every other war agency and would hinder the prosecution of the war. By the nature of its assignment, we fear it would tend to become a pressure agency seeking to quicken demobilization for its own sake, forgetting war needs.

Congressional Function Not Overlooked

Since the controversy over control between the executive and legislative branches of the government is sure to be long and drawn out, and may be interpreted in many different ways, readers will be interested in direct quotations from the report:

"We are recommending that these steps be taken by Executive order *for the time being* because of the urgency for quick handling of immediate surpluses, and because additional experience gained in actual administration is needed before legislation can be definitely drawn.

"We recommend:

"That the Surplus Administrator report to Congress as soon as possible on legislation that is needed, basing his recommendations on actual experience with the problems.

"Nor should our recommendations be interpreted as ruling out a still further centralization of the handling of surpluses if experience indicates such a change desirable. Bringing the problem under a firm, managing hand *now* will facilitate smooth transition to any setup that Congress ultimately legislates."

The report further goes on to say:

"We do believe Congress should lay down whatever policies it feels wise and desirable to guide the existing agencies in their handling of demobilization problems. This view was expressed before the Special Committee of the Senate on Postwar Economic Policy and Planning on Dec. 21, 1943. The weeks of intensive work on these problems that have passed confirms that judgment."

Among the specific recommendations of the report is the strengthening of the industry advisory committees of the War Production Board, a prompt extension of the needed war powers which include the price control law, priorities and allocations power on which functioning of the War Production Board rests, requisitioning power of the President, and a study by the Attorney General of other war powers of agencies to determine when they will expire, which can be allowed to lapse, and which should be extended.

It is conceded by disinterested observers in Washington that these recommendations or a reasonable facsimile must be put into effect. Without the continued regulation of prices the nation faces uncontrolled inflation, and without the properly functioning industry advisory committees, industry cannot assume its share of the responsibility of the demobilization without becoming enmeshed in the anti-trust laws.

The policy for the continued production of minerals and metals suggested by Mr. Baruch is contained in his recommendation for "an early, equally effective review of the programs for the production of raw materials, for stockpiling, for imports, for subsidies and premiums to marginal producers.

"To continue any of these programs beyond their need is to prevent the production of more of what is needed. Where materials are in excess of military needs, civilian uses should be expanded or, if that cannot be done, because of manpower, the production or import of these materials should be cut back.

"This will release resources for a new balance of the program at a higher level. Always the program must be kept in balance."

Reports USBM Work on Ferro-Alloy Reserves

At the recent New York meeting of the A.I.M.E. Edward F. Fitzhugh, Jr., described some of the recent exploratory work of the Bureau of Mines. His remarks about development of reserves of some of the ferro-alloys complete the stockpile picture given the mining industry at the Denver meeting of American Mining Congress and Colorado Mining Association by E. F. Hatch, acting director of the Ferro-Alloy Branch, Steel Division, War Production Board. Mr. Fitzhugh said:

"At the close of the last fiscal year the Bureau's exploratory development of tungsten deposits had indicated nearly 2,000,000 tons of ore with an average content of 0.65 per cent WO_3. To establish these reserves the Bureau carried out 17 successful exploratory development projects in Idaho, Wyoming, Nevada, Utah, Colorado, and other Western states. More recently a noteworthy project has been going forward at the Hamme mine, in North Carolina. The hübnerite in this echelon system of veins is a further significant addition to tungsten reserves.

"In the year ended last July the explora-

tion program added 1,800,000 tons of indicated reserves of chromite to a previous total exceeding 4,000,000 tons. Thus the Bureau's exploratory investigations have now established approximately 6,000,000 tons of chrome ores with an average grade between 19 and 20 percent Cr_2O_3. To outline these reserves, exploratory trenching, tunneling, and drilling were carried out on more than 20 deposits in Alaska, Montana, Oregon, and California.

"Last spring, when the mills serving the Colorado-Utah vanadium field were faced with an impending shortage of ore, the Bureau of Mines undertook an intensive drilling campaign. This project has recently come to a successful close, after establishing new sources of ore in a number of separate deposits. In addition to the drilling in the sandstone areas, further exploration was carried out during the year on the vanadium-rich sediments of the Phosphoria formation in Wyoming and Utah.

"Molybdenum investigations include deposits in Alaska, Montana, and North Carolina. In recent months the exploration of the Boy Scout mine, in North Carolina, has revealed one of the most extensive deposits in the Eastern states.

"Trenching and drilling have been going forward on two nickeliferous iron deposits in the State of Washington."

FEA Releases Data On Mineral Imports

At the end of February, Leo T. Crowley, Foreign Economic Administrator, issued a statement covering deliveries of strategic commodities from foreign countries purchased with government funds during 1943. The total value was $809,000,000, of which $496,000,000, or 61.3 percent, was devoted to mineral purchases. Mineral deliveries during the first six months had a value of $232,000,000 and during the last six months a value of $264,000,000. These figures do not include imports consummated under FEA control but for private account. Also, they do not include purchases made in neutral countries for the purpose of keeping the commodities from reaching the Axis.

Purchase missions were sent to Latin America, Africa, India, China, Australia, and the Pacific Islands. Minerals imported include mica, copper, tin, chrome, nickel, zinc, beryl, tantalite, fluorspar, manganese, and quartz crystals.

New Form to Apply for New Mining Equipment

As part of the process of simplifying paper work in complying with WPB regulations, WPB has issued Form WPB-1319, to be used by mines and smelters seeking new equipment in place of Form WPB-2910. This form will dispense with the need for separate applications for authorization and ratings, and will also eliminate several special forms used in connection with limitation orders.

No Relief for Mine Manpower Problem

Bottom of the manpower barrel has been reached in many of the mining areas of the West. By late February draft boards had begun to take men from the mines in accordance with a new policy concerning occupational deferments affecting men 18 through 21 years of age, effective Feb. 1. Also by late February complaints had reached Washington and the Copper Division of the War Production Board had asked that 18 to 22 year old men in the copper mines be deferred. It was claimed that production of copper would be curtailed from 5 to 10 percent, which would bring annual production below requirements established by the military.

At the time of going to press no answer had been made to the protest of the Copper Division. Unofficially it was pointed out that to be consistent no exception could be made and that if favorable action was taken on the Copper Division's request for preferred treatment, copper mines would be the only exception.

Selective Service instructed local draft boards in these word: "Effective Feb. 1, 1944, no registrant (whether a nonfather or a father aged 18 through 21 at the time he is classified) may be considered as a 'necessary man' entitled to be placed in Class II-A or Class II-B unless a request for deferment filed with the local board on Form 42-A Special has been endorsed by the State Director who recommends that the local board except the registrant from the restriction against occupational deferment of registrants ages 18 through 21."

Most Washington officials other than those concerned with copper apparently are not fearful that a cut in production due to the drafting of the 18 to 22 year olds will prevent mineral requirements from being fulfilled. The reason is that most metals are in very good supply. In the case of the ferro-alloys, E. F. Hatch, Assistant Director for Ferro-Alloys, WPB Steel Division, told the Mining Congress at its recent Denver meeting that stocks of manganese, chrome, tungsten, and vanadium are approximately one year's supply at the current rate of consumption. Mr. Hatch also said that rutile, zircon, baddeleyite, and columbium are available in adequate supply.

One of the most recent official statements as to the relative supply of metals is the Metals Substitutions and Supply List Number 11 of January 15. It says, "The most significant changes in issue 11 are the easing of copper and steel to Group II." It also points out that, contrary to the general trend, lead is advanced from Group III to Group II, due to a gradually declining supply. Group II materials are those currently in sufficient supply to satisfy war and essential industrial demands. Group I materials are in insufficient supply and Group III materials are in excess of current essential needs. The only metals listed in Group I are bismuth, cadmium, platinum, sodium, tantalum, and tin.

New Interest Aroused in Domestic Corundum

Corundum workings in Montana are being investigated and developed by the Bureau of Mines. It is estimated that possibly 10 percent of domestic requirements can be supplied from this source.

The quality of domestic corundum is equal to the best imported materials. The investigations of the domestic deposits were undertaken when substitutes for corundum superfine flours, used by the optical industry, proved to be of much lower abrasive efficiency. The optical industry does not have a sufficient supply for its needs, and imports are still below domestic requirements.

Congress and President Clash Over Tax Bill

An historic incident occurred in late February when much-criticized, patient Senator Alben Barkley, of Kentucky, Senate majority leader, broke with President Roosevelt over the latter's message vetoing the tax bill over which Congress had struggled for several months. Barkley's insurgency was not over the veto itself but because of the flippant cynicism with which the message dismissed Congress' carefully deliberated bill. The President characterized the bill as constituting relief for the greedy rather than the needy. Barkley, whose loyalty to the Administration has been unswerving during his several years as majority leader, cracked back that the message was a calculated and deliberate assault on the integrity of every member of Congress, and resigned the majority leadership.

Taken by surprise, the President receded from his position, promptly wrote Barkley denying that his intent was to question the integrity of Congress, and expressed the hope that the Senate would continue Barkley as majority leader. This the Senate did, but both houses of Congress overrode the veto by substantial majorities, with many critical remarks directed toward the White House and the Treasury. The net result was a further deepening of discord between the President and Congress, further loss of Treasury prestige in Congress, and renewed hopes for the re-election of Senator Barkley. The latter, whose last re-election was accomplished only by the lavish outpouring of public funds in Kentucky by the Administration during the campaign, had been counted an easy "kill" by Republicans in the forthcoming election.

In his veto message the President reiterated his stand against percentage depletion. Passage of the bill establishes the extension of percentage depletion and of excess profits tax exemption to certain non-metallic minerals (*E. & M. J.*, Jan., page 89), also the Johnson Amendment clarifying the definition of "gross income from the property." The latter measure is to prevent the "chiseling" which the Treasury has been doing to producers of certain minerals, such as quicksilver.

NEWS OF THE INDUSTRY

A.I.M.E. Meeting Draws Record Attendance

More than 3,000 members and guests registered at the Waldorf-Astoria Hotel, in New York, Feb. 20 to 24, for the annual convention of the American Institute of Mining and Metallurgical Engineers, an attendance that made the meeting the largest in the Institute's history. During the meeting, 56 technical sessions were held, among which those on postwar mineral control, Eastern magnetite mining and milling, and characteristics of flotation machines aroused most attention.

The session on postwar mineral control was a discussion of the course advocated by Dr. C. K. Leith, of preventing the outbreak of war in the future by controlling the mineral supplies of potentially belligerent nations. Admitting the difficulties of administration inherent in such a program, Dr. Leith stated that majority opinion of those who had participated in discussions of the subject was that control could and should be exercised by supervising international traffic in oil, steel, and light metals. He recognized that effective control would involve considerable international regimentation of the industries affected. He also stated that the control organizations would be in fact cartels and that there would have to be modification of anti-trust laws before domestic organizations could cooperate.

Opposing Views Expressed

Speaking in opposition, Dr. Paul D. Merica, vice president of International Nickel Co., characterized such a program as impossibly cumbersome, and recommended as a substitute that control be exercised over the manufacture of war material. His view was that it would be impossible to detect the stockpiling of raw materials for war without overrunning suspect countries with international police, but that detection of war equipment manufacture would be relatively simple. He pointed out that adequate control would require control of re-exports and of substitutes, and would stimulate rather than discourage economic nationalism. His conclusion was that raw-material control might prevent aggressors from winning wars but would not bar them from starting wars.

Speaking on petroleum, W. B. Heroy, of the Office of the Petroleum Administrator for War, stated that oil was necessary to sustain modern war and that the lack of a suitable reserve would make it impossible to wage war successfully. He pointed out that coal could be substituted for petroleum at some additional cost in terms of manpower.

Philip D. Wilson, discussing the light metals, expressed the viewpoint that raw material control would be futile except to prevent the accumulation of large stockpiles. He urged that as soon as the war is over, all the light-metal plants in Axis countries not necessary for purely domestic and peaceable purposes should be shut down, including all magnesium plants.

H. Foster Bain, former secretary of the Institute and eminent authority on Far Eastern minerals, said that the outstanding Oriental problem of mineral control would involve iron and steel. Dr. Bain stated that China is the only Oriental country with sufficient reserves of coking coal to support a major steel industry, and that the natural combination would be based on Chinese coals and Indian iron ores. Bain pointed out that mineral control can be an act of war as well as of peace, and that both Japan and Italy declared war when faced with the application of mineral sanctions. He advised that "we should not reach for our guns unless we are ready to shoot," and cited the Pearl Harbor incident as a result of the opposite course. He also criticized the current popular attitude toward cartels, stating that they should be modified and used for peceful aims. He gave the International Tin Committee as an example.

G. C. Bateman, of the Department of Munitions and Supplies of Canada, sided with Dr. Merica, and stated that the relatively simple job of gearing Canada's mineral industries for war involved such complexities that he considered the project of world mineral control impossibly difficult. He pointed out that several successful international cooperative agencies had been developed during the war, and hoped for their continuance. He advised an international policy of controlling mineral surpluses and scrap to prevent the demoralization of markets, and also held for an interntional currency based on gold. He stated that a mineral stockpile would be unnecessary for Canada because it constantly produces surpluses over its domestic needs, and stressed the vital necessity of encouraging prospecting and mineral development.

A paper by W. S. Tower, of the American Iron and Steel Institute, was not read in full in the author's absence. Dr. Leith discussed a portion which pointed out the difficulty of controlling Germany in terms of iron and steel without crippling the nation's economy, the production of large surpluses being normal to German peacetime activity.

At the annual banquet of the Institute, held on the evening of Feb. 23 at the Waldorf, more than 1,500 members and guests witnessed the presentation of various medals and awards, among which was the Charles F. Rand medal, given "for enhancing the prestige of metal mining" to Cornelius F. Kelley, chairman of the board of Anaconda Copper Mining Co. The gathering was addressed by Mr. Kelley and by Chester A. Fulton, president of Southern Phosphate Corp. and new president of the Institute.

Mercury Producers Meet in Denver

An emergency meeting of mercury producers was held in Denver on Jan. 29 to consider the effect on domestic production of the recent price slump. From a ceiling of $197 to $199 per flask, placed by the OPA on the metal in 1942, the New York quotation began dropping early in January and was published as low as $130 per flask by the end of the month.

At the Denver meeting, presided over by R. J. Lund, director of the miscellaneous minerals division of the WPB, producers were asked to name the price levels at which their mines would cease operations. The consensus was that at current production costs and a New York price of $150, domestic production would be at a rate of about 46,000 flasks a year. At $130 they estimated that output would fall off to 33,000 flasks, and at $100, it would drop to 22,000 flasks.

Mr. Lund stated that mercury requirements had fallen from an estimated 1943 demand of 90,000 flasks to an actual consumption of about 54,000 flasks. Domestic mines produced almost exactly this amount in 1943, and imports, largely from Canada and Mexico, amounted to another 50,000 flasks. Because of rapidly increasing stocks, approaching a two-year supply, the WPB recommended late in 1943 that Metals Reserve Co. cancel its contract with "qualified" producers—i. e., new mines or mines producing less than 90 flasks in April, 1942. This action precipitated the market price drop.

Despite the stocks of the metal on hand, the WPB feels that it is desirable as a safeguard to keep at least a segment of the domestic industry in continuous and substantial operation. It was to determine the price level necessary to maintain this segment of production that the WPB arranged for the Denver conference.

Four days after the meeting, mercury conservation order, M-78, was officially revoked, and approximately 4,000 flasks per year of currently-produced metal is to be supplied to hitherto prohibited uses.

Reconsider Rhodesian Copper Output Cut

Following worldwide publication of an announcement that output of Rhodesian copper mines would soon be cut 20 to 25 percent because of the improved supply situation of the metal, a statement was issued on Feb. 10 by William L. Batt and Sir Charles Hambro, United States and British members, respectively, of the Combined Raw Materials Board, to the effect that some reduction of copper production was planned, but not, perhaps, as great an amount as that originally announced. The statement follows:

"A recent announcement by the British government of its intention to reduce copper production in Northern Rhodesia has aroused considerable attention. Some reduction is desirable, due to the fact that copper is competing with vitally needed coal and metallurgical chrome for the limited rail facilities in that area. The question of the magnitude of the cut in copper production is still under discussion by the CRMB and British authorities.

"When the determination of the extent of the Rhodesian reduction has been made, a statement will be forthcoming."

The story of the first announcement as carried by news services in this country was in error in stating that plans for a £1,500,000 plant expansion at N'Changa had been abandoned. Additions to N'Changa's facilities will be carried out according to plan.

Extend Premium Period for Strategic Mica

The special price program for obtaining strategic sheet mica has been extended by Colonial Mica Co., agent for Metals Reserve Co., to Dec. 31, 1944, an additional period of six months. Also, as an incentive for early delivery to meet estimated requirements, the purchasing organization will pay a bonus of $1 a pound for all domestic strategic sheet mica delivered before June 30, 1944. This is equivalent to raising the price from $5 per pound to $6 on sheet mica meeting specifications established early in December.

Reynolds Metals Co. to Mine Haitian Bauxite

Reynolds Mining Corp., a subsidiary of Reynolds Metals Co., has been granted a concession by the Haitian government to mine bauxite and other ores of aluminum in the island republic, according to an announcement on Feb. 13 by Walter L. Rice, president of the mining company. Negotiations on behalf of the company were conducted by Mr. Rice with Elie Lescot, president of Haiti, over a period of several months.

Richest deposit of the bauxite has been found in the southern peninsula of the Republic only three miles from the sea. The material is said to have different properties from those of American and Guiana bauxite—particularly low silica content, for example. Dr. Warren J. Mead, head of the geological department at Massachusetts Institute of Technology, supervised the investigation that resulted in discovery of this new source of aluminum.

Following the original investigation, Reynolds Mining Corp. sent a party of geologists into the field, headed by Dr. Walter L. Whitehead and working under the general direction of Dr. O. C. Schemedeman, chief geologist of the company. The taking and analysis of several hundred samples confirmed the nature and extent of the deposits. Dr. S. S. Goldrich, of the U.S.G.S., is in Haiti studying them.

Zinc Institute to Hold Annual Meeting

The 26th annual meeting of the American Zinc Institute will be held on April 17 and 18 at the Jefferson Hotel in St. Louis, Mo. Last year the Institute's customary convention was omitted, but, according to the current announcement, there are now many subjects that need to be discussed by the zinc industry, and the April meeting will provide an appropriate occasion. Among such subjects are: war needs and essential requirements, manpower problems, stockpiling, competitive products, and future markets for zinc.

Bonus Paid 22 Percent of 1943 Copper Output

Approximately 22 percent of the total domestic mine output of copper in 1943 received premium payments, according to F. H. Hays, acting chief of the primary production branch of the copper division, WPB, speaking before the members of the American Mining Congress and the Colorado Mining Association in Denver recently. Only 10 percent of the 1942 production was over-quota, he added.

Mr. Hayes presented the following statistics on domestic primary copper production for 1942 and 1943, in tons.

	1942	1943
Open-pit mines	545,414	591,747
Underground mines	543,175	512,875
Total	1,088,589	1,104,622
No-premium copper	986,154	825,713
Premium copper	102,435	246,612
Production under RFC contracts	.....	32,297

The copper industry employs approximately 52,000 men in mines, mills, smelters and refineries, he said. Of the total, about 37,000 work in mines and mills. Mr. Hayes also said that 19 mines in 1943 produced 92 percent of the primary copper obtained in the United States; 13 mines produced 82 percent of the copper obtained from underground operations, and 6 open-pit mines produced all the copper obtained from surface mining.

Ferro-Alloy Metals in Adequate Supply

Ferro-alloy metals have moved into an easier supply position, reflecting changed military requirements and improved shipping conditions in connection with those items that are secured from foreign sources, according to an analysis of the situation by E. Franklin Hatch, assistant director for ferro-alloys of the WPB steel division.

Projected military requirements for alloy steel have dropped from 1,500,000 tons per month to 1,000,000 tons, although current needs are still large compared with prewar demand, as the following figures indicate:

Consumption of Ferro-alloy Metals

	Prewar	Current
Manganese, tons	674,583	1,400,000
Chrome, tons	362,873	900,000
Tungsten, lb.	5,047,800	17,151,000
Molybdenum, lb.	23,149,800	53,825,000
Vanadium, lb.	1,519,600	3,672,000

Note: Tungsten, molybdenum, and vanadium figures are in pounds of recoverable metal.

Domestic production of these metals compares with that of the prewar period as follows:

Production of Ferro-alloy Metals

	Prewar	Current
Manganese, tons	30,683	175,000
Chrome, tons	1,506	100,000
Tungsten, lb.	2,803,600	10,274,000
Molybdenum, lb.	23,130,200	58,726,000
Vanadium, lb.	653,600	3,497,000

As protection against contingencies, stocks on hand at the beginning of 1944 amounted to 1,525,000 tons of manganese ore, 1,100,000 tons of chrome ore, 18,683,000 lb. of tungsten, 29,674,000 lb. of molybdenum, and 2,433,000 lb. of vanadium, excluding vanadium ore.

Zinc Imports to Rise Mining Congress Hears

Speaking before the joint meeting of the American Mining Congress, Western Division, and the Colorado Mining Association in Denver, Jan. 27, Myron L. Trilsch, assistant director of the zinc division of the WPB, said that during 1944 the major task confronting the zinc industry would be that of adjusting domestic production and imports of the metal to essential civilian needs and to military requirements, which have reached, for the time being, a stabilized level.

Mr. Trilsch added that the outlook for 1944 contemplates smelter output and imports of slab zinc essentially equal to those during 1943, but with regard to supply of concentrates, domestic mine output is expected to be somewhat lower than in 1943, largely due to an anticipated decline in the Tri-State area, and increased imports are expected to "more than compensate" for any drop in domestic mine production.

Statistically, the zinc position during 1942 and 1943, with an outlook for 1944, was summarized by Mr. Trilsch as follows:

Zinc Concentrates and Slab Supply, Consumption, and Stocks

(In thousands of short tons of slab and recoverable zinc)

	1942 (Actual)	1943 (Partly Estimated)	1944 (Estimated)
Concentrates			
Domestic production and imports	1,082.5	1,193.2	1,191.7
Stocks at end of year	307.8	352.0	416.0
Slab zinc			
Domestic production and imports	988.4	1,050.2	1,057.9
Domestic consumption and exports	916.0	940.2	911.8
Stocks at end of year			
Producer and government	82.8	190.0	336.0
Consumer	76.9	86.0	86.0
Total stocks	159.7	276.0	422.0

PERSONAL NEWS

Search is being made for relatives of Harry Cummings, who died recently at the age of 57. He is believed to have been employed or engaged in metal mining in Michigan and in the West from about 1911 to 1926. His parents were John and Mary Thompson Cummings. Pertinent information should be sent to **Walter C. Cox,** 208 S. LaSalle St., Chicago, Ill., probate genealogist for the estate's attorneys.

Walter M. Webb, of Ironwood, Mich., superintendent of the Penokee Ore Co., subsidiary of the Republic Steel Corp., has retired after 34 years of service with the Republic. Mr. Webb began his iron mining career in 1906 with the Pittsburgh Iron Ore Co., on the Mesabi Range.

Dr. Edward L. Clark, assistant manager of the Joplin (Mo.) WPB office and regional technical adviser for WPB, planned to leave March 4 for Rolla as assistant State Geologist for the Missouri Geological Survey and Ground Water Resources.

Lucien Eaton, of the staff of the engineering firm of H. A. Brassert & Co., New York, N. Y., is now in western North Carolina supervising a drilling campaign being conducted by the U. S. Bureau of Mines to determine the extent of the State's iron ore resources.

John W. Huddle, associate professor of geology at the University of North Carolina, has been granted a leave of absence and now is assistant geologist with the U. S. Geological Survey.

Selwyn G. Blaylock, president and managing director of the Consolidated Mining & Smelting Co. of Canada, Ltd., of Trail, B. C., has been elected an honorary member of the A.I.M.E., "In recognition of his eminent standing as metallurgist, engineer, and administrator of mining and metallurgical enterprises; and the effective and patriotic service he has rendered his country and the United Nations."

John C. Mitchell, captain of the Hull underground mine, at Eveleth, Minn., on the Mesabi Range, was on Feb. 4 presented with a gold medal in honor of his completion of 50 years of continuous service with Oliver Iron Mining Co.

Robert Marsh, Jr., consulting engineer, Tucson, Ariz., is the recipient of a citation by the First Pan-American Congress of Mining Engineers and Geologists recognizing his improvements in the extraction of caliche and his cooperation in the development of the copper mines of El Teniente and Chuquicamata.

R. W. Michael, mining engineer, has returned from Venezuela, where he has been engaged for one year in investigating diamond concessions, in the Caroni area, for Compania Anonima Minera de Diamantes "El Pao." He is here for a visit of about four months and then expects to start exploitation in Venezuela. His New York address is Park Chambers Hotel, 68 West 58th St., New York.

D. S. McAfee, vice president and a director of The Dorr Company, has arranged to terminate his association with

D. S. McAFEE

the company. For several years Mr. McAfee has specialized in equipment and methods for the process industries, working not only in North America but also in South America and parts of the Far East and Europe.

Walter L. Rice, vice president of Reynolds Metals Co., has been elected president of Reynolds Mining Co. He succeeds **R. S. Reynolds, Sr.,** founder of the company, who now becomes chairman of the board.

Dr. Robert F. Mehl, director of the metals research laboratory and head of the department of metallurgical engineering at the Carnegie Institute of Technology, has gone to Brazil to lecture at the Escola Politecnica of the University of Sao Paulo on advanced practices in the application of the science of metallurgy in the United States.

W. W. Lynch has resigned his position with Metals Reserve Co. and now represents Calumet & Hecla Consolidated Copper Co. in New York City, succeeding **George L. Craig,** who has become director of research for C. & H. at Calumet, Mich.

James S. Wroth has been elected vice president of International Mining Corp. He was formerly with the U. S. Bureau of Mines and has had professional experience in the United States, Canada, Mexico, and various countries of South America and Europe.

James Alexander, superintendent of Fontana mine, a copper property operated by the North Carolina Exploration Co. near Bryson City, N. C., has moved to Asheville, N. C., following the permanent closing of the mine because it is in the reservoir basin of the T.V.A.'s Fontana Dam.

H. DeWitt Smith, New York mining engineer, formerly a director of Newmont Mining Co., and vice president of Metals Reserve Co., has succeeded **G. Temple Bridgeman** as executive vice president of MRC. Mr. Bridgman will join the staff of **William L. Clayton,** recently appointed Surplus War Property Administrator.

J. Gordon Hardy, president of Falconbridge Nickel Mines, Ltd., was made a member of the Half Century Club of the A.I.M.E. at the February meeting of the Institute in New York.

Benjamin N. Webber, field geologist for U. S. Vanadium Corporation, formerly residing at Phoenix, Ariz., is now living at Grand Junction, Colo.

Charles S. Reed, of Rapid City, S. D., has been elected president of the Black Hills Mining and Industrial Association of South Dakota. **Jack D. Johnson,** of Lead, has been made vice president, and **Clyde Cessna,** of Rapid City, secretary-treasurer.

Hans Lundberg, of Toronto, was presented the John Ericsson Medal at the annual dinner of the American Society of Swedish Engineers held in New York on Feb. 11 last. The medal is awarded every other year for "distinguished achievements in science and engineering."

J. A. H. Paterson, recently of the staff of the Metals Controller of Canada, has been made general manager of the Mining Corporation of Canada.

S. B. Dickey, Jr., has severed his connection with Cerro do Pasco Copper Corp. and has accepted a position as chemist with Aramayo Mines of Bolivia, at Telamayu, Bolivia.

Howard S. Renken, who has been associated with extraction metallurgy and smelting for 20 years, and from 1925 to 1942 with American Smelting & Refining Co., has joined the research staff of the Battelle Memorial Institute, Columbus, Ohio.

Albert L. Toenges, metallurgical engineer with the U. S. Bureau of Mines, has been at the Bureau's Reno station and in other Nevada districts from the Pittsburgh, Pa., station.

J. M. Basham, who has been associated with the Mountain Copper Co., Shingle Springs, Calif., for 30 years, has severed his connection to accept the post of consulting engineer for the various operations of Mountain Copper, a position formerly held by the late Albert Burch. He will maintain an office as consulting engineer in Shingle Springs.

Harold L. Hazen has been appointed manager of the 1,000-ton plant of the Manganese Ore Co., subsidiary of M. A. Hanna Co., of Cleveland, Ohio, which is treating low-grade manganese ore from the Three Kid's mine, in Clark County, Nev. He succeeds Walter P. Hester. Mr. Hazen

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is president of the Standard Cyaniding Co., which closed its open-cut gold mine and 700-ton cyanide mill in Pershing County, Nev., late in 1942.

Prof. J. Ellis Thomson has been appointed head of the department of mineralogy of the University of Toronto. He has been associated with the University since 1912, was for three years with the Royal Canadian Institute, and in 1938 president of the Mineralogical Society of America.

Howard T. James, managing director and consulting engineer of Pioneer Gold Mines of B. C., Ltd., at Bridge River, B. C., has been elected chairman of the Mining Bureau of the Vaucouver Board of Trade. He was also recently made president of the Mining Association of British Columbia.

Walfrid Been has been made assistant superintendent at the Hartley-Fraser and Fraser underground iron mines at the Chisholm, Minn., properties of Oliver Iron Mining Co., and **Lloyd S. Campbell** has been made assistant superintendent of Fayal iron mine, at Eveleth, Minn.

P. A. Wickham has been appointed manager of the operations of Jardine Mining Co. and has taken over his new position at Jardine, Mont. He was formerly manager of Little Ben Mining Co., Landusky, Mont.

Frank A. Wardlaw, manager of International Smelting & Refining Co., and **E. H. Snyder,** president and general manager of Combined Metals Reduction Co., have been elected to the board of governors, western division, of the American Mining Congress.

Fred M. Connell, of Toronto, has been appointed to succeed **George C. Bateman** as Metals Controller of Canada. He had served as deputy controller since the organization of the Bureau.

William E. Dennis has been appointed associate engineer for the U. S. Bureau of Mines.

Richard L. Scott, recently on the staff of Kennecott Copper Corp., is now associated with Braden Copper Co. as a shift boss.

Arthur Kendall has joined the staff of Bagdad Copper Corp., Hillside, Ariz., having recently resigned as superintendent of Resurrection Mining Co. operations at Leadville, Colo.

Albert Wende, of Buffalo, N. Y., has succeeded Dr. W. P. St. Charles, deceased, as president of Lake Shore Mines, Ltd., at Kirkland Lake, Ont.

R. Downey, for the past several years mill superintendent of the Granby Consolidated Mining, Smelting & Power Co., at Allenby, B. C., departed at the end of February for Ricran, Peru, to take a position as mill superintendent with the Vanadium Corp. of America.

Hugh J. Hamilton, an electrical engineer, has been appointed director of the University of Utah Engineering Experiment Station, Salt Lake City, Utah. Dr. Hamilton is a graduate of California Institute of Technology, where he holds degrees of bachelor of science, master of science, and doctor of philosophy in engineering.

H. J. Rahilly has become general superintendent for Anaconda Copper Mining Co.

Cornelius F. Kelley, chairman of the board of Anaconda Copper Mining Co., was on Feb. 24 awarded the Charles F. Rand Memorial Medal for "distinguished achievement in mining administration." The presentation was made at the annual dinner of the American Institute of Mining and Metallurgical Engineers, at the Waldorf-Astoria, New York.

Arthur A. Center, consulting engineer of New York, has accepted an appointment as head of the department of mining and metallurgical research of the University of Utah, and will soon leave for Salt Lake City to assume his new duties. Dr. Center is a graduate of the Montana School of Mines, where he holds degrees of engineer of mines and metallurgical engineer, and of Yale University, where he was awarded the degree of doctor of engineering.

Obituaries

John H. Collier, mining engineer of Oakland, Calif., died in that city on Jan. 20, 1944.

F. C. Carstarphen, Denver mining engineer and an authority on construction of aerial tramways, died in January following a heart attack.

Charles Bur Grant, long a resident of the Kingman, Ariz., mining region, died on Feb. 17. Mr. Grant had been associated with the Chloride mine for several years. His age was 60.

J. C. Ryan, pioneer mining man of Spokane, Wash., died Jan. 21 at the age of 87. He had large mining interests in the Kootenay district of British Columbia and formerly operated the Soho mine, in Slocan district.

Rensselaer Hyde Toll, West Coast mining engineer, and associated with mining development in California since 1900, died on Feb. 9 at the age of 71. Mr. Toll was at one time vice president of the Los Angeles Chamber of Commerce and for many years a member of the American Institute of Mining and Metallurgical Engineers.

Thomas Edward Campbell, 66, Governor of Arizona from 1919 to 1922, died at Phoenix, Ariz., on March 1.

Kernick Smith, mining engineer and geologist, was killed in action in the battle of Munda, in the Solomons area, in July 1943. He entered the service soon after Pearl Harbor and at the time of his death was a captain in the Army Air Force Intelligence Service. He was the son of the late Claude Smith, one of the developers of properties at Goldfield, Nev. He was graduated from Stanford University in 1932.

Harry Thomas Hamilton, treasurer and a director of the American Institute of Mining and Metallurgical Engineers, and assistant to the president of the New York Trust Co., with which he had been associated since 1927, died at Summit, N. J., on Feb. 5 at the age of 63.

William Herbert Moulton, Ishpeming, Michigan, died Jan. 30th at the age of 81. He was born in Phillips, Me., Aug. 25, 1863, and in 1884 graduated from the Worcester Institute of Technology, Worcester, Mass. In 1905 he came to Ishpeming and established the welfare department of the Cleveland-Cliffs Iron Co. He directed the department until his retirement in 1938.

James B. Allen, pioncer miner of Park City, Utah, died at his home on Feb. 15 at the age of 74. Mr. Allen organized the Glen Allen Mining Co. to develop properties on the east side of Park City near Keetley. These are now part of the area worked by New Park Mining Co.

Bert Roby, Sr., died in Phoenix on Jan. 23. Mr. Roby moved with his parents into Oklahoma at an early age. At the turn of the century he went to Mexico, where he operated, principally in the State of Durango, for a number of years. During this period he was president of the Santa Cruz Mining Co. After leaving Mexico he mined in New Mexico, subsequently coming to Arizona, where he has operated for nearly twenty years.

Dr. Edward O. Ulrich, 87, former curator of geology for Cincinnati Society of Natural History, for ten years editor of "The American Geologist," paleontologist, and author, died in Washington, D. C., on Feb. 22 last.

Alfred Stansfield, professor emeritus of metallurgy at McGill University, Montreal, Quebec, Canada, died on Feb. 5 last at Westmount, Ontario, in his 73rd year. He was an author of note on various phases of metallurgy, a vice president of the Electrochemical Society, and a member of many professional and scientific organizations, including the Engineering Institute of Canada and the Canadian Institute of Mining and Metallurgy.

D. J. Kennedy, manager of San Antonio Gold Mines, Ltd., Bissett, Manitoba, long professionally prominent in the Mid-West mining region of the United States and in various districts of Canada, died on Jan. 26 last. He attended the Colorado School of Mines and the University of Nevada, and before settling in Canada permanently had been associated with mining enterprises in Mexico, Arizona, California, and British Columbia.

William H. Loomis, president of the Loomis Talc Corp., of Gouverneur, N. Y., and a leader in business, social, and civic life in the northern area of New York State, died in Brookline, Mass., on Feb. 12 last. He was 73.

Roscoe Randall Knuckey, consulting metallurgist with experience in many countries and recently in the United States in connection with the sink-and-float process

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for Huntington, Heberlein & Co., died in London on Jan. 26. He was a member of the Institution of Mining and Metallurgy and of the American Institute of Mining and Metallurgical Engineers.

Arthur Keith, geologist, long associated with the U. S. Geological Survey, which he joined in 1887, died at Alexandria, Va., on Feb. 7, at the age of 79. Mr. Keith entered Harvard at the age of 16 and received his A.B. degree in 1885 and his M.A. in 1886. He did postgraduate work at Lawrence School in 1887. He was the author of many scientific papers and reports and was elected to the presidency of the Geological Society of America in 1927. Mr. Keith was a member of the National Research Council and of many learned, scientific, and civic societies.

Letters

Federal Control of Mineral Deposits on Public Lands

The Editor:

CONCERNING THE CONTROL of mineral deposits by the Federal Government:

As a holder of claims and mine operator in California, I believe I can give some coherent reasons why such a control would become a boon to, and greatly benefit, both prospector and prospective operator in this State. Of other states I have very little knowledge.

To remove the registration from the jurisdiction of the counties would in itself justify the proposed act. For most of our mining counties are completely controlled by cattlemen, who own, control, and actually are the county government. Thus they are able and do block prospecting and developing of much potentially productive mineral land.

They can and do readily accomplish this end, by falsely assuming ownership of government property; by falsely assuming mineral rights of purely grazing lands; by falsely claiming contamination of water supply and blocking the construction of access roads. These are the main methods of closing thousands of prospective claims to the prospector, and since the perpetrator of these methods is, you might say, the judge and jury also, what chance has a prospector in trying to locate on these lands, so controlled?

These facts (which are facts and not suppositions) are, as stated above, sufficient reasons for removing all mineral and prospective mineral properties belonging to the government from control by counties.

That the government will perhaps in future years realize some income from such a course is problematical, and in my belief secondary, mainly, because for some time the expenditures are likely to far overshadow the income, which should be proper provided such a program is efficiently inaugurated. For:

I believe that a prospector wishing a license should be entitled to receive from the government a map of the particular locality in which he is interested, showing clearly all parcels of land upon which he be entitled to prospect. Such maps are not now available and would entail quite an expenditure to prepare, but I believe they are quite essential to such a program.

Not knowing what the content of such an act entails, and even though my suggestions may overlap, I believe it should include the following:

First: That all claims should require a small rental until actual mining production is commenced. Then proceed on a royalty basis. Both to be reasonably small enough not to stifle development. Mining as a whole cannot stand the amount of royalty that oil can carry.

Second: That a definite period of time be allowed between location and start of operation. Failure to start operations, automatically to lay claims open to filing.

Third: That all claims now held and unoperated be classified as above.

Mind you, I hold claims, some of which I would relinquish under the aforementioned rules. And gladly so, realizing that a good many of the so-called paper-hangers sitting on claims, sometimes numbering into the hundreds, will be obliged to produce or release their claims.

Without a doubt (in my mind) control by the government will open thousands of mining possibilities which under local control are closed by so many abuses that the benefit to the mining industry will greatly overshadow whatever the government may derive from the industry.

Personally, I am willing to pay the government a royalty and gladly, just to have the present evils removed. After all, aren't the ones who howl the loudest against federal control the very ones who wish to continue local abuses? I think so.

WM. J. PETTY

Inyokern, Calif.

Editor's Note. An excerpt from Mr. Petty's letter was published in a summary of comment in our issue for December 1943. His full letter is published herewith because he thought the excerpt did not contain some of the most pertinent items in his original letter in the interest of miners and prospectors.

Ever-Normal Stockpiles

The Editor:

SINCE the directors of A.I.M.E. passed early in 1943 the resolution proposing the stockpiling of critical minerals by the government, much has been said and written on this subject, and at this time S. 1582, introduced by Senator Scrugham, of Nevada, is under consideration in the Senate.

With few exceptions, the written and oral comments on the subject have been favorable to the general idea of stockpiling, but the discussion has all emanated from those who are more or less directly interested in the production of metals and minerals. Therefore we may be accused, and perhaps rightly so, of self-interest in the matter.

If this is a matter for Congressional consideration and action, it must be a matter affecting the general welfare of the nation as a whole.

There is no question whether or not it would have been desirable to have had substantial stocks of all metals at the time of the Pearl Harbor incident. Why we did not have such stocks is water under the bridge now, but the fact remains that since that fateful day we have been engaged in a terrific scramble to produce enough metals to keep up with demands for armaments. That we have been able to meet the demand has been due to the fact that no enemy action prevented the orderly procedure of mining, milling, smelting, and transportation. If the bombing of Gary, or Bingham Canyon, or the locks of Sault Ste. Marie had been possible, the war situation would have had a different aspect today.

The amount of metals to be stockpiled is a matter for determination by the War and Navy departments, but the administration should be vested in an expert, non-partisan board. Fears have been expressed that such stockpiles in the hands of the government might be a serious threat hanging over normal markets. On the other hand, a well-advised governmental policy in connection with stockpiling seems to offer an opportunity for price and market stabilization which would be desirable.

The writer proposes the following plan:

1. That a normal price for each metal be determined and agreed upon by the industry and the government.
2. That the minimum quantity of each metal desired for stockpiling be determined by the government.
3. That the government purchase all of the metals offered to it by domestic producers, at the normal price.
4. That when the market price is higher than the normal price, the government shall sell any metal stocks held, in excess of the minimum stockpile requirements, at the purchase price plus interest and carrying costs.
5. That if certain metals desired for stockpiles are not obtainable from domestic sources, the government shall buy these from any other source desired.
6. That the stockpile requirements and normal prices be reviewed from year to year and such changes made as are deemed necessary or desirable.
7. That adequate tariff protection be maintained to control imports so that the normal price to domestic producers can be sustained.

This seems to be a simple and workable program. It contains no suggestion of governmental regulation, control, or supervision of production; there is no preference in price or otherwise to domestic sources of supply. It should serve to encourage new development, as it will give a much-needed stability to the industry. Naturally the question of cost arises, but in considering this, the cost of keeping labor in non-productive W.P.A. jobs during periods of depression and the present extraordinary cost of procuring metals under the duress of war must also be weighed.

Hanover, N. H. J. A. NORDEN

SPEEDS UP WORK

SAVES MATERIAL

The Mining Industry can well be proud of its war-time production record. Its high-operating efficiency — developed during peace—had much to do to bring the war to its "final phase."

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REGIONAL NEWS

CALIFORNIA

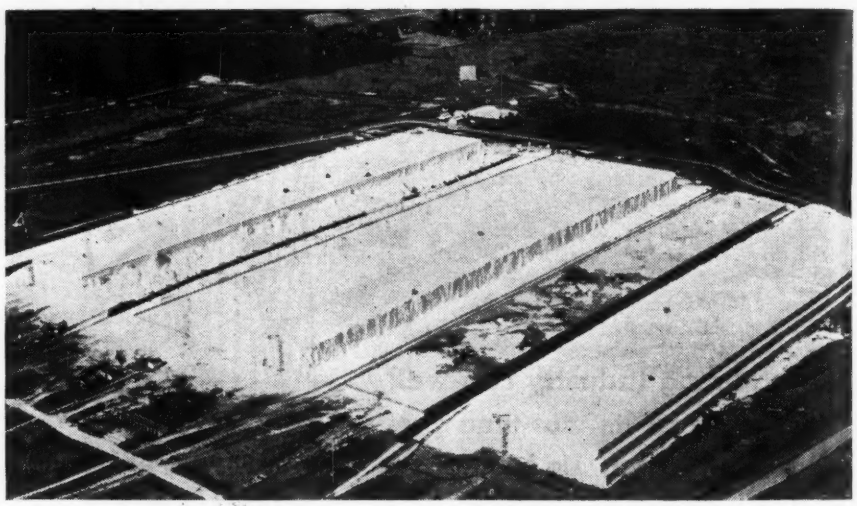
Hecla's zinc mine near Hornitos begins production — Central Eureka employs 20 men in timbering

▶ Total value of mineral production of California for 1943 is conservatively estimated by the Statistical Section of the Division of Mines, Department of Natural Resources, to have been $419,536,000. This figure exceeds by $10,798,000 that of 1942. Gold production, 148,000 oz., was the smallest of any year since 1848, because of WPB's gold mine closing order of Oct. 8, 1942. Copper output is estimated at 17,950,000 lb.; lead, 11,650,000 lb.; zinc, 3,750,000 lb.; and silver, 610,000 oz. Output of practically all other minerals, especially of chromite, iron, manganese, molybdenum, tungsten, and quicksilver, increased during the year. Reports indicate that the 1943 production of quicksilver exceeded that of 1942, which amounted to 30,087 flasks and was the largest since 1896. Industrial minerals showed a slight increase over the record for 1942, as did the saline group. Walter W. Bradley, State Mineralogist, with offices in the Ferry Building, San Francisco, heads the Division of Mines.

▶ Dewatering operations at the Hathaway mine, in the Ophir district near Auburn, Placer County, held under bond and lease by Sonoma Quicksilver Mines, H. D. Tudor, president, are proceeding satisfactorily, and the water level in the 800-ft. shaft has now dropped to the 450 level. The planned examination and exploration program will be started as soon as all water has been removed from the shaft. The property, idle since 1907, was worked for gold, but presence of strategic minerals is indicated. Stanley F. Wickham, superintendent, is in charge of operations.

▶ The new 50-ton mill under construction at the Hi-Peak tungsten mine by U. S. Flare Corp. near Inyokern, Kern County, is scheduled to be completed early in March, with milling operations to start immediately thereafter. Electric power will be furnished by a 100-hp. diesel unit, and ore treatment will involve grinding in a Marcy rod mill and tabling. A considerable tonnage of mined ore is reported to be available for milling. J. M. Hoyt is president of the company, Victor J. Hayek, mine manager, and Norman Whitmore, engineer. Private funds were used exclusively to bring the property to production stage.

▶ Regular zinc production has started at the Blue Moon mine, near Hornitos, Mariposa County, operated by Hecla Mining Co., of Wallace, Idaho, with concentrate being trucked to Merced Falls for shipment to smelter. At the mine, the shaft has been deepened to 400 ft., and lateral work is in progress. A road connecting the mine and mill has been completed by the Bureau of Highways, and plant buildings completed recently include a hoist and change room, a blacksmith shop, a compressor house, and an office. The mill, formerly handling gold ore from the Jenny Lind mine and leased from Pacific Mining Co., has been remodeled by the company to treat zinc ore. Finished concentrate is taken by Metals Reserve Co. About 40 men are employed under the direction of Robert Dunn, superintendent.



HUGE BLOCKS OF SULPHUR at the Newgulf plant of Texas Gulf Sulphur Co. Pumped molten from the ground, the sulphur is cooled and solidified in enormous vats (note second block from right), which are gradually built up to a height of 50 to 60 ft. Blasted down as needed, the sulphur is reclaimed (note block at left) by power shovels and railroad cars

Photo from Three Lions

▶ Retimbering work is in progress between the 3,000 and 3,500 levels in the Central Eureka mine, at Sutter Creek, one of California's leading gold producers before WPB's gold mine closing went into effect. About 20 men are employed. L. A. Norman, Jr., general superintendent, has been granted a leave of absence by the company to become supervising engineer for Colonial Mica Co., of North Carolina, and during his absence his duties have been taken over by T. Calvert Slater, geologist.

▶ Discovery of a substantial orebody carrying good values in copper in the old Pioneer mine, in El Dorado County, has been announced by Volo Associates, the operators. The company, a recent consolidation represented by O. H. Griggs, operator of Western Manganese Mines, in Plumas County; F. V. Phillips, president of Volo Mining Co.; and James Melone, of Sundown Mines, in Plumas County, controls the Lilyama, Pioneer, and Emma properties, in the Pilot Hill area of El Dorado County. Mined ore is treated in the mill leased by the associates from Volo Mining Co. It was converted recently from milling gold to copper ore. H. Rosborough is mine superintendent, and E. L. Reeves is in charge of the mill.

▶ Operation is reported to be up to capacity at the tungsten property at Darwin, Inyo County, operated by Pacific Tungsten Co., an E. L. Cord subsidiary, with 6,000 tons of newly mined ore and reclaimed mill tailings being handled monthly. Mine output is treated in the Keeler mill of West Coast Tungsten Co., the Cord milling unit, about 20 miles from Darwin. A. N. Sweet, general manager, directs operations.

NEVADA

Cordero Mining Co. closes its furnace plant — Pershing Quicksilver Co. changes hands

▶ Cinnabar claims and the furnace plant of Pershing Quicksilver Co. in the Relief district, Pershing County, have been purchased by H. B. Chessher and Leo F. Schmidt, of Reno, from the First National Bank of Chicago, trustee for the estate of the late George Hubert Jones, Chicago banker and industrialist, who in 1928

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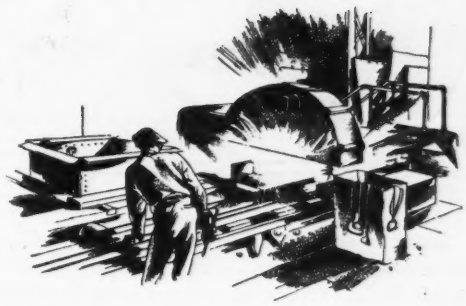

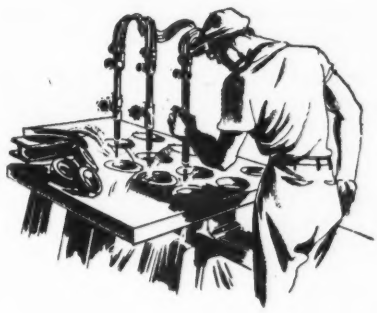

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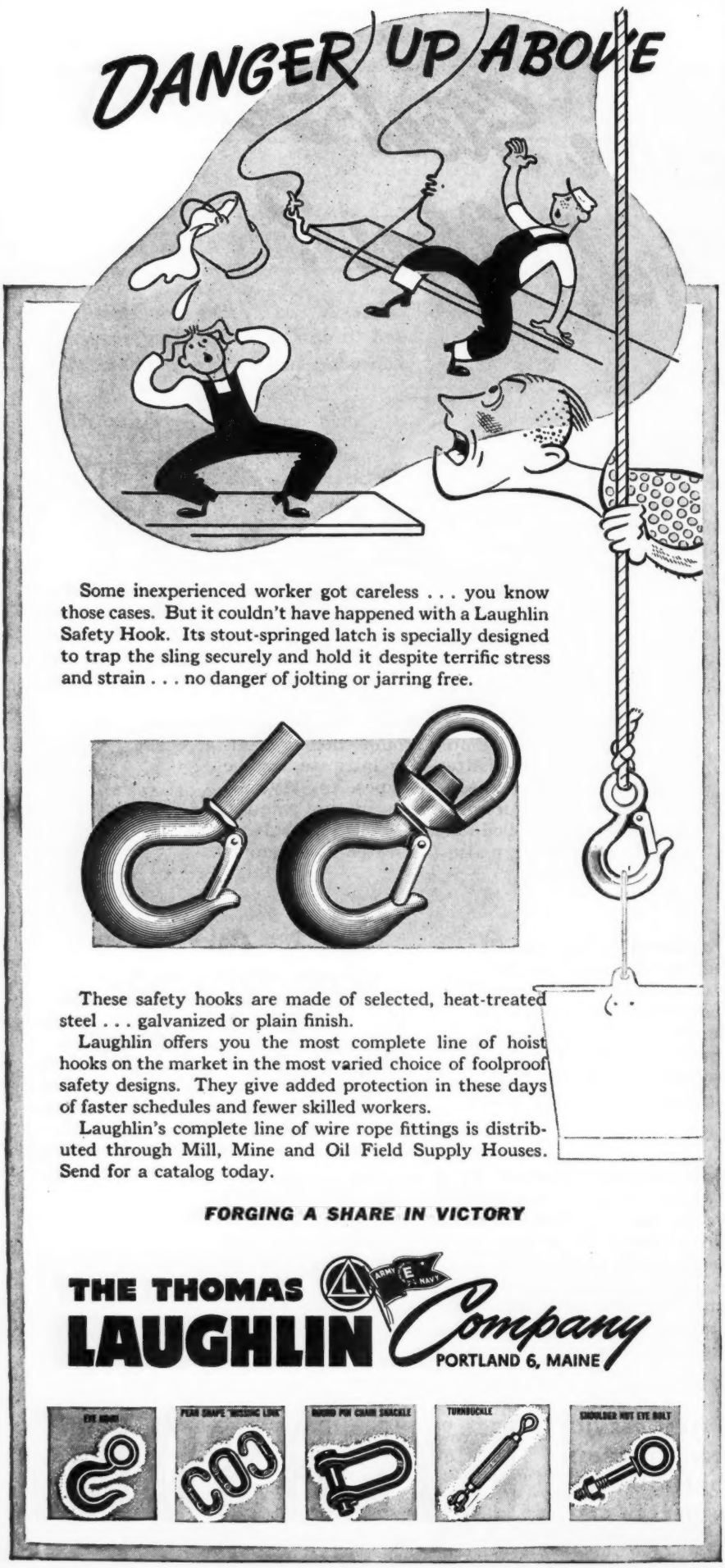

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FORGING A SHARE IN VICTORY

THE THOMAS LAUGHLIN Company
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Nevada *(continued)*

spent around $250,000 for plant and development. In 1941 the bank advanced $50,000 to reopen the mine and plant, and, equipped with 80-ton Nichols-Herreshoff and 60-ton Gould rotary furnaces, it has since produced from 80 to 90 flasks of mercury per month, paying all bank advances, operating only the Nichols-Herreshoff unit. It was stated the purchase was for cash, at a figure far below the salvage value of equipment. The new owners, who bought the corporation outright, indicated they would be unable to operate with mercury at a price below $140 per flask. New officers are H. B. Chessher, president; Leo F. Schmitt, vice president and treasurer, with Lile R. Messer general superintendent. Other directors are A. Livingstone, of Lovelock, and W. G. Adamson, of San Francisco.

▶ Scheelite concentrate of high grade is produced by the 125-ton concentrator of M. G. L. Mining Corp., operating in the Nightingale range in southwestern Pershing County, postoffice address, Fernley, Nev. Mill feed has ranged from 80 to 100 tons per day. The ore is trucked two miles from the mine, higher on the mountain, and water is pumped from the flat near Winnemucca Lake at the west. Arthur Letts, Jr., of Los Angeles is president.

▶ Cordero Mining Co., largest Nevada producer of mercury, closed down its 125-ton Nichols-Herreshoff furnace plant in mid-February at its cinnabar mine in northern Humboldt County. J. Ford McCormick, manager, was said to have stated at his office at nearby McDermitt that shaft sinking and contract drilling would continue, and that production may be resumed late in March. The company is an affiliate of Horse Heaven Mines, Inc., operating quicksilver property in Oregon. President of both is J. Edgar Pew, head of Sun Oil Co. and Pennsylvania Republican leader. A bulletin of the U. S. Bureau of Mines lists the Cordero Mining Co. among the ten largest U. S. mercury producers last year. Termination of bonus payments by Metals Reserve Co. and cancellation of contracts by other purchasers foreshadow the probable closing down of many Nevada producers.

▶ Deposits of mica in eastern Clark County near the Arizona line are to be examined by the U. S. Bureau of Mines. Some muscovite was produced during the first World War south of the area where W. F. Murdock, of Sacramento, Calif., has located nine claims. Mica is said to be present in a belt extending north along the State boundary line for 20 miles or more.

▶ Claims located for quartz crystal near the old La Panta gold mine, in central Mineral County, have been sold by Hy Werner and associates, of Hawthorne, to southern California men, who are providing large-scale mining equipment. Surface work with a scraper is said to have exposed a large quantity of the crystal, but little is of high quality.

▶ With completion of an access road to

the Red Dog zinc-lead property, an early-day producer 22 miles north of Jungo, in Humboldt County, shipments at the rate of 50 tons per day were said to have been started by Warren Overholser, of Winnemucca, who had unwatered and repaired old workings.

▶ A cinnabar property with 20-ton rotary furnace, known as the Cahill mine, situated near Poverty Peak, in eastern Humboldt County, has been acquired under lease and option by George Johnson, lately working copper claims in Paradise Valley and now living in Reno. Development will continue through a 120-ft. incline before production is begun. In one year the late Jack Cahill is said to have produced around $80,000 in mercury.

▶ Several carloads of high-grade scheelite have been shipped to the Salt Lake City tungsten plant operated for Metals Reserve Co. by U. S. Vanadium Corp., from property of the B. & C. Tungsten Mining Co. in the Pine Nut range in Douglas County, worked under lease by Henry Koocher, of Reno, with Joe and Sam Miller, of Fallon. The claims were located after much prospecting at night with a fluorescent lamp by David G. Wood, veteran miner and assessor of Alpine County, Calif., from whom the B. & C. company acquired the ground under lease and option. Koocher was one of the most successful lessees at Goldfield.

▶ The management of Griff Mines, Inc., developing during the past two years the old Antelope lead-zinc-silver mine, in Pershing County, has been seeking a lease on the 40-ton mill six miles from the company's mine, built several years ago, with new equipment to treat gold-silver ore from the original Scossa discovery by the late J. W. Lambert. The plan is to install equipment for selective flotation.

▶ Said to have been producing around 1,000 units of tungstic oxide per month, Nevada Scheelite Co., with a mine near Rawhide and a mill at Dead Horse Well, in Mineral County, has been rated one of the most successful tungsten operations in Nevada during the past two years. Recent prospect drilling by the U. S. Bureau of Mines was said to have extended greatly the proved ore zone.

ARIZONA

White Hills mine sold—Group plans placer manganese plant—Columbite found at Dungan mine

▶ Mrs. Florence Mackie and associates have sold the White Hills mine, about 30 miles north of Chloride, to Earl Cook, J. R. Payne, and R. V. McAllister, all of Kingman, who are planning to ship manganese ore already blocked out in the previous operation. The White Hills group consists of 32 patented claims.

▶ Cactus Queen copper mine, in the Alamo district of Mohave County, is being opened up by Roy J. Heyne, of Phoenix,

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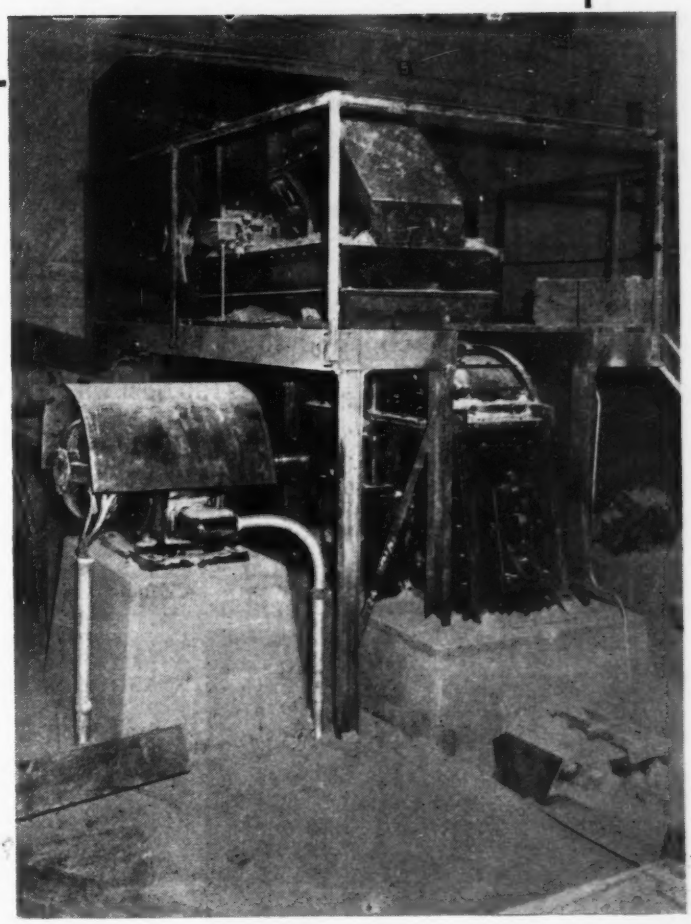

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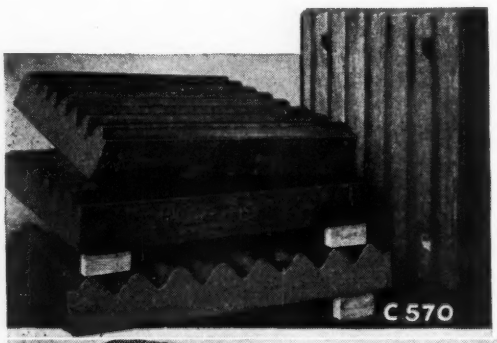

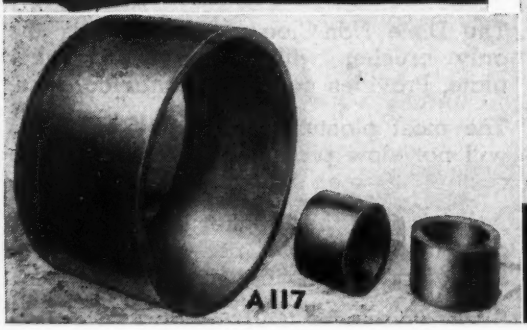

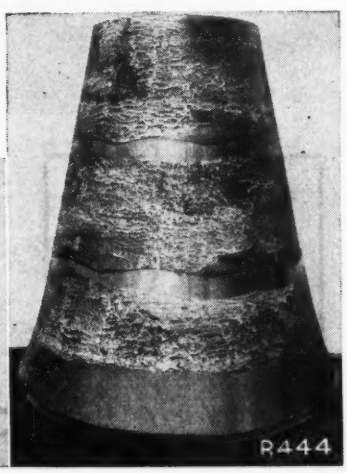

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Arizona *(continued)*

and J. D. Long, son of the late George W. Long. The 190-ft. shaft will be retimbered to the 160-ft. level, above which is a considerable tonnage of oxidized ore. Shipments will be made to the Clarkdale smelter. J. L. McIver, Phoenix, and the George W. Long estate are owners of the property.

▶ R. P. Cummings, Phoenix, and associates have dismantled the pilot plant on Castle Creek and are planning to build a standard concentrating unit on the mining property. The details of recovery of manganese from a placer deposit were worked out in the pilot plant.

▶ Duane Bird, of Nogales, and C. A. Pierce, of Carlsbad, N. M., owners of the Three R mine, in the Palmetto district, Santa Cruz County, are shipping ore to the Hayden smelter.

▶ B. N. Hulbert, Mesa, superintendent of Midco Reserves, Inc., now working the Pine Mountain mine, in the Sunflower district, has a crew of 20 men at the property. The mine produces mercury.

▶ Completion of the surface plant at the Springfield mine, in the Crown King district of Yavapai County, has been handicapped by bad weather. Shipments were expected to start about the middle of February, according to P. R. Helm, of Crown King, who is manager.

▶ Application for an RFC loan has been made by J. H. Dungan, of Kingman, for mining the Dungan tungsten property in the Greenwood district of Mohave County. During the first World War a considerable amount of high-grade tungsten ore was produced by lessees. It was recently reported that significant quantities of columbite, the mineral of columbium, a critical metal, have been found in the Dungan ore.

▶ E. I. Mills and F. P. Bracken, owners of the Abe Lincoln mine, in the Castle Creek district of Yavapai County, announce that the construction of an access road to the property has been approved by the WPB.

▶ Daily shipments of zinc-lead ore are being made from the Aravaipa mine, in the Klondyke district, to the Shattuck Denn Mining Corp. mill at Bisbee. The Aravaipa mine is operated by Athletic Mining & Smelting Co., James F. Orr, Safford, general manager.

▶ Ten tons of scheelite ore from the Zannaropolis mine, in the Eureka district of Yavapai County, has been shipped to the Phoenix stockpile. J. P. Robinson and J. P. Zannaras, both of Hillside, are the owners.

▶ Ted Schutz, Humbolt, is in charge of operations for lessees at the Lookout mine, in the McCabe district of Yavapai County. Present work consists in the installation of pumping equipment.

▶ James F. Maffeo, Bisbee, lessee of the King in Exile mine, in the Rosemont district of Pima County, is making regular shipments of zinc-copper ore to the Shattuck Denn mill at Bisbee. Newton Wolcott, of Warren, is in charge of operations.

COLORADO

State develops new calcium carbonate industry—Mendota mine hoisting ore—Leadville tunnel is advancing

▶ Ross D. McCausland, operating the Lark mine, on Cement Creek near Silverton, ha purchased a new road tractor, and the mine will be run through the winter.

▶ Wallace K. Howard has completed the installation of a hoist at the winze on the fourth level at the Mendota mine, near Silver Plume, and has started hoisting ore. He reports encountering a streak of 20 percent zinc ore, carrying 15 percent lead, the streak being about 2 ft. wide. The ore will be milled at the Mendota mill and the bulk concentrates shipped to the Golden Cycle mill, at Colorado Springs, for selective separation.

▶ Boulder Tungsten Mills Inc., the largest tungsten operation in Boulder County, and the latest important operation in the field, installed a milling plant two years ago to treat the gravity plant tailings of the district, together with tungsten ores from its several mines. A chemical treating plant in Salt Lake City, Utah, receives the low-grade ferberite flotation product. The plant is on North Boulder Creek about a mile east of Lakewood and four miles east of Nederland, and its principal sources of gravity mill tailings are the Primos mill, at Lakewood; the Wolf Tongue mill, at Nederland; and the Vasco and the Clark mills, at Tungsten. Comparatively simple milling methods have been practiced because of the high specific gravity of the ferberite, which lends itself to ordinary gravity concentration methods.

▶ The old Plymouth mill, at Montezuma, has been taken over by Haggard, Johnson, and Jones, and has been reconditioned. It is intended to treat custom ore from this district. Paul L. Jones, manager, expected to start operating the mill by Feb. 1.

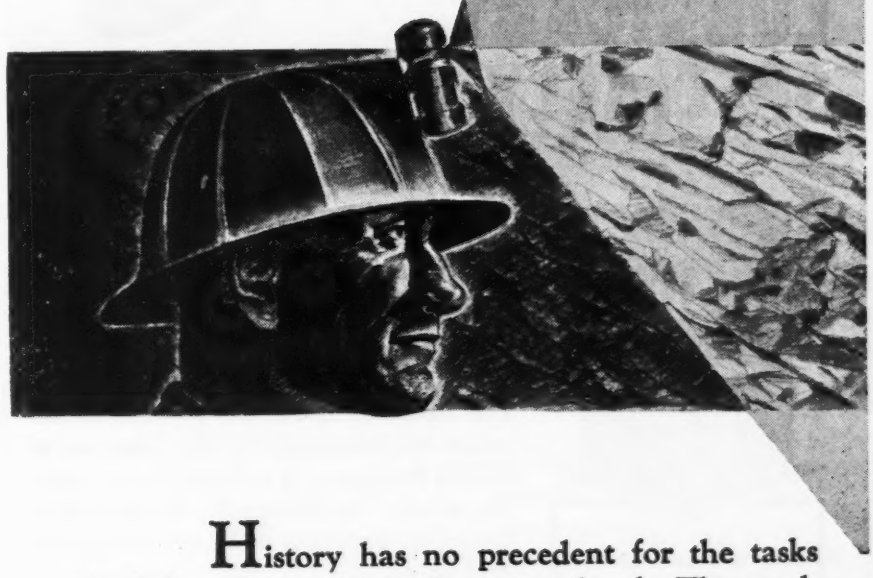
▶ Robert Wilfley's discovery of a manganese deposit on town property in Box Canyon Park, Silverton, proved a nice windfall to the city. The royalty amounts to more than $2,000.

▶ The U. S. Vanadium Corp. mill at Uravan, largest vanadium mill in the United States, has been closed down temporarily by a lack of coal. It is reported, however, that operations were interrupted for only a few days, and that the plant is again running. Other operations of the company in western Colorado, including the 100-ton plant at Rifle, and a small plant at Uravan, were unaffected.

▶ Frank Stewart, operating the Stewart mine, on Italian Mountain near Gunnison, has his winter campaign of prospecting and developing work completely under way so that he can start shipment of zinc, lead, copper, gold-silver ore this spring.

▶ Eugene Bruell, of Cleveland, Ohio, recently shipped 40 tons of beryllium ore

"WHEN THE LIGHTS GO ON AGAIN ALL OVER THE WORLD"



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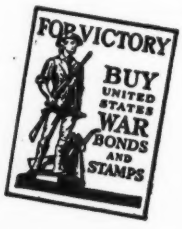

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Colorado *(continued)*

from his mine, near Loveland, to the stockpile at Salida.

► Guy Pyle, superintendent of Hardrock Mining Co., continues his steady production from the Nancy mine, in Four Mile Canyon west of Boulder.

► A compressor has been installed at the Diamond tunnel of the Dives-Pelican, near Georgetown, by Charles Sutton and John A. Smith. They have cleaned up the tunnel level, retimbered it and now have an excellent showing of complex sulphide ores.

► Colorado has developed a new mineral industry during the past year, with the discovery of limestone having a calcium carbonate content of 99.73 percent. This is used for fertilizer, stock feed, and finer-sized chicken grits. The pure limestone is quarried along the Ute Trail by Salida Calcium Products Co., and the 200-ton per month output is not sufficient to meet the demand.

► Bert Wright, building contractor, has removed his crew of workmen from the snow-covered country at the Urad Molybdenum mine, above Idaho Springs, until spring. Molybdenum Corp. of America expects to have its mill at the Urad mine treating ore in March. At present, large stopes are being opened up, so that the 200-ton mill, built by Southwestern Engineering Co., can be kept in steady production. This property was operated during the first World War, and has been the scene of much government work during the past two years, as the Defense Plant Corp. purchased the mine in 1942, at a cost of $110,000, giving the Molybdenum Corp. the right to repurchase later. At that time the government set aside $250,000 for immediate development and specified an additional expenditure of $500,000 for the erection of a mill and other necessities. Walter J. Eaton, mining engineer, is superintendent of the property.

► P. & J. Mining Co. has unwatered the 250-ft. level of its Bull Domingo mine, three miles from Silver Cliff, and George D. Parks and George W. Jump have started mining the zinc orebody. This is one of the oldest mines of the State.

► Good progress is reported at the Leadville drainage tunnel. The open cut is completed and the tunnel is well into the hill. About sixty men are now employed at the scene of operations, and a modern and convenient change room is being erected for the tunnel drivers. A fine sand, recently encountered, is thought to be part of a glacier formation, as it runs like water.

► The Monte Cristo mine of Golden Cycle Corp., on Hoosier Pass in Summit County, had a production of more than 10,500 tons of zinc-lead ore during the last half of 1943. This surface property, at an elevation of 10,700 ft., was originally worked in the early '70s, yet the inaccessibility of the mine and low prices of metals prevented operations there during recent years. The zinc-lead ore is deposited on the surface to a depth of about

eight feet, and is broken by jackhammers, blasted, loaded by power shovels into trucks, hauled to the railroad spur at Buena Vista, and then shipped to the mill at Colorado Springs. P. B. Van Dolah, superintendent, has a crew from the Cripple Creek district. This property closed in December because of heavy snow, but it will be reopened this spring.

▶ The Mickey Breen Mine, near Ouray, has opened a new vein of high-grade lead ore. The streak, 15 to 18 in. wide, is exposed for 30 ft., and E. W. Creel, in charge of operations, reports that he is constructing a tram to carry the ore to the road. Creel has been developing this property for several years.

▶ Conejos Corp., under the direction of Otis A. Roberts at Cripple Creek, is unwatering the Denver City mine. A gasoline hoist, pumps, and other equipment have been installed. The mine is about 16 miles southeast of Gunnison.

▶ G. Sessinghouse, Denver operator, is shipping a considerable tonnage of manganese ore from the Fairview mine, near Silverton.

▶ J. E. Jarratt is attempting to reopen the Hayden Comal Corp. mine, the Sutton, two miles from Ouray.

▶ F. A. Sitton, president of the Montezuma Mines Co., has started production of vanadium and uranium from the Mike O'Neill vanadium claims in Dolores County near Dove Creek. Six claims have been opened, and development work is progressing. Ore is trucked from the property to the government stockpile at Durango.

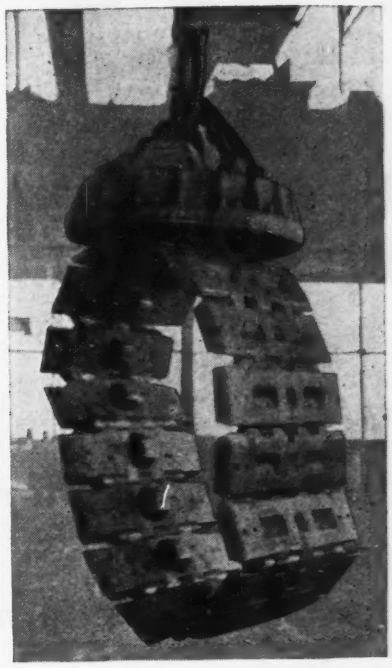
UTAH

Utah Copper's new electric plant now operating—A.I.M.E. local section votes against unionization of engineers

▶ Members of the Utah Section of the A.I.M.E. voted decisively against formation of an institutional union "in self-defense against the attempts of labor unions to unionize the mining engineers in this country." Passage of the resolution at the January meeting followed discussions of the recent "self-defense" action of the American Society of Civil Engineers.

▶ Operation of the Utah Copper Co.'s new electric power plant at Magna started for the first time on Feb. 17, according to D. D. Moffat, president and general manager. Construction started in Feb., 1942. Design changes and substitutions for equipment made unavailable by the war delayed completion. The 50,000-kw. plant will supply power for all of the company's operations at the Bingham mine and the Magna and Arthur mills. One of the largest industrially owned plants in the West, the new installation has more automatically controlled apparatus than any other steam electric plant in the western United States. The 365-ton

Getting a LIFT with a Stearns MAGNET



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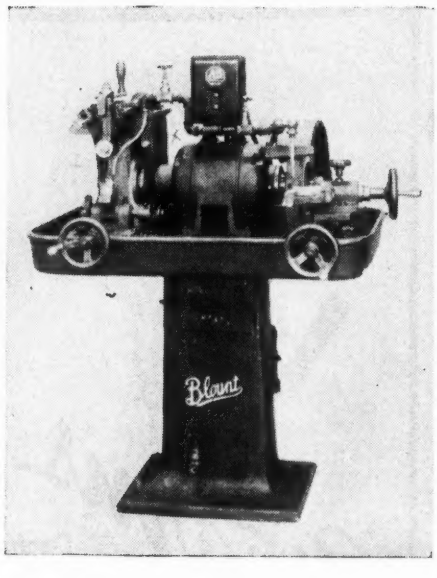

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Utah *(continued)*

turbo-generator unit is hydrogen-cooled. The two boilers supply steam at 900 deg. F. H. P. Early is the chief engineer. Design and construction has been directed by E. J. Franklin, special engineering consultant to the copper company.

▶ Operations at the Big Indian property, now being operated by Percy Kittle, president, and associated with the Ohio Copper Co. of Utah, are progressing favorably. L. B. Birch, mill superintendent, is directing work at the LaSal property, 40 miles south of Moab. The ore is being mined from the sandstone and delivered to the crude-ore bins by bulldozers for treatment in the 250-ton flotation plant.

▶ Park City Consolidated Mines Co., formerly operating at Park City, announces through Richard C. Badger, executive vice president of Salt Lake City, that its Missouri property at Frederickstown, 92 miles south of St. Louis, is producing 300 tons of ore and a 50-ton carload of concentrate daily. The company's milling plant of 500 tons' daily capacity was completed on Dec. 30, 1943.

▶ At the request of the Garfield Smeltermen's Union No. 347, the industrial hygiene division of the Utah State department of health has been asked to study the possible effect of smelter smoke and dust on the health of Garfield residents.

▶ Exploration in the "development unit" of Tintic Standard Mining Co. and North Lily Mining Co. is now entering an interesting stage, Harold Bowman, Salt Lake City Chamber of Commerce mining committee chairman, reports. The two companies are investigating the possibilities of 143 acres comprising parts of the Eureka Lilly, the Twentieth Century and other claims. Since 1941, 8,000 ft. of development work has been done in the area and several promising ore showings have been cut in the drift run from the Tintic Standard 1454 level.

▶ Chief Consolidated Mining Co. is shipping steadily increasing quantities of zinc-lead ore from the Eureka property's below-water-level zone.

▶ The National War Labor Board has directed the Utah Copper Co. to negotiate with two unions in an effort to reach an agreement relating to wages and working conditions for 1,100 employees at the Bingham mine. The International Brotherhood of Electrical Workers (AFL) and the International Union of Mine, Mill, and Smelter Workers (CIO) have been certified by the WLB as exclusive representatives for the two groups of workers at the mine. If by April, the unions and the company do not work out an agreement, the WLB will hold a public hearing.

▶ Revenue Mines Co., a Colorado corporation, will have headquarters at 411 Felt Building, Salt Lake City. Allan Hoover, Palo Alto, Calif., son of former President Herbert Hoover, is president of the company; L. K. Requa, of Salt Lake City, is vice president; and Frances B. Requa, also of Salt Lake City, secretary. W. M. Cutler, of Ouray, is general manager.

MONTANA

New mill at Jardine now in operation—Small mines hurt by rapid decrease in supply of labor

▶ The new 300-ton mill for the Jardine mine is now in operation, as well as the new plant for the production of arsenic trioxide. Milling operations were started on arsenopyrite ore stockpiled from development work in the mine while the mill was under construction. Development work is being pushed on the 10, 11, and 12 levels of the mine, and stoping will begin when the mill has consumed the development ore.

▶ W. C. Giebel, of Great Falls, is operating the Emma lead and zinc mine, in the Rochester district of Madison County. The Emma mine was owned by Mrs. W. S. Gage, of Twin Bridges, Mont. It has a small vein of high-grade ore mined selectively and shipped directly to the smelter.

▶ Silver Star Chrome Co., operating near Silver Star, in Madison County, is treating 30 tons of chromite ore daily in the old Iron Rod mill, situated on the highway between Silver Star and Twin Bridges. The Iron Rod mill has been remodeled and tables have been installed. W. M. McLean, of Helena, supervised the work of remodeling the mill. Prior to completion of the mill, the chromite ore was mined selectively and shipped to the Metals Reserve Co.'s stockpile in Butte. The mine is near Silver Star. The chromite, occurring in lenticular bodies in the Pony gneiss, is mined via adit crosscuts and is trucked from the mine to the mill, a distance of several miles. This is the only chromite mining operation currently active in Montana.

▶ The U. S. Bureau of Mines is sinking a shaft in the Johnny Gulch talc deposit, on Johnny Gulch in Madison County. L. F. Teutsch has leased the deposit from Lewis Clark, of Ennis, Mont., and is currently producing ceramic and lava-grade talc. Approximately 30 tons of ceramic talc are mined for each ton of lava-grade talc recovered. The product is sold to the American Lava Corp., Chattanooga, Tenn. Current production is at the rate of approximately 50 tons of ceramic-grade talc per month. All mining to date has been in open pits and from shallow adits. No deep development work has been done in the deposit. The talc occurs as lenticular bodies 5 to 10 ft. wide, in dolomite. The property was formerly operated by the Tri-State Minerals Co. of California.

▶ The Running Wolf iron-ore deposits near Stanford, in Judith Basin County, and the Sheep Creek iron-ore deposits in Meagher County, were drilled recently by the U. S. Bureau of Mines. Both deposits have figured prominently in plans for the promotion of an iron blast furnace plant in Montana and have been involved in numerous arguments over the question of whether or not Montana has enough iron ore to support a blast furnace.

▶ The few small mines still active in

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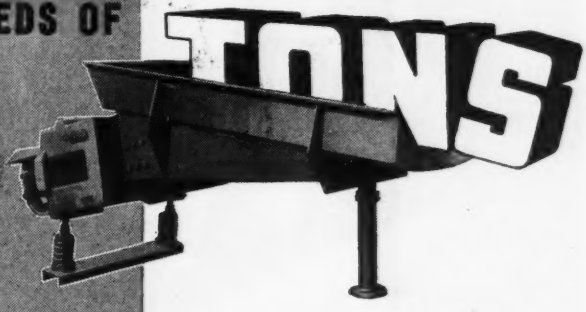

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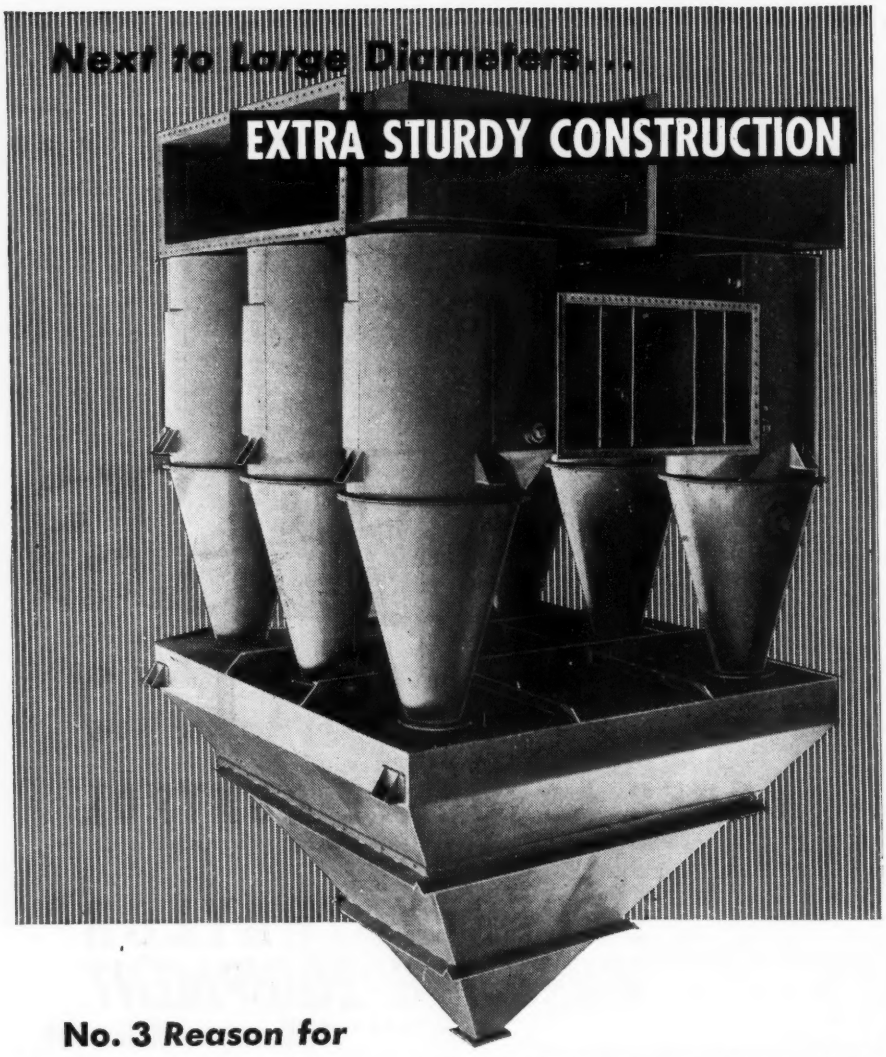

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Montana *(continued)*

Montana are contending with an acute labor shortage that grows worse month by month. Most have been compelled to curtail operations. Among these the Boaz mine, at Norris, has closed its mill for the duration and is now high-grading and shipping ore direct to the smelter. In many operations the remaining mine crew is made up of local residents who are only part-time miners. These men live on farms and ranches, and in the spring and summer they cannot work in the mines. When labor was more plentiful, and the big percentage of the crews at the small mines were professional miners, this spring migration of the farmer-miner group worked little hardship on the mining operations. In the spring of 1944 it may be a serious matter for small-mine operators.

IDAHO

Yellow Pine's 106-mile power line completed—Mines reopened near Arco—Hecla reports

▶ An electric power line 106 miles long, carrying 66,000 volts and costing $1,000,000 has been completed into tungsten-antimony-gold mine of Bradley Mining Co. in the Yellow Pine district in what is known as the "Primitive Area" of Idaho. Two years ago the district was isolated except for a rough wagon road passable for only a few weeks in summer. At that time the mining camp, called Stibnite, contained fewer than 300 people; today it boasts of a population of 2,000, all of whom are engaged in mining and milling gold, tungsten, antimony, and quicksilver ores. Because of censorship regulations, exact tonnage of the district is not given out, but it is reported that the value of the minerals shipped out of the district will exceed $1,000,000 a month.

▶ Hecla Mining Co. has declared its first quarterly dividend of 25c. a share for the year 1944, totaling $250,000 and payable March 10 to shareholders of record Feb. 10. This payment brings Hecla's total dividend record to $27,405,000. For many years a lead-silver mining company, Hecla has since the beginning of the present war, turned to the production of zinc from a number of new sources. The company owns a half interest with the Bunker Hill in the Sullivan zinc plant and the Star mine, admittedly the largest zinc mine in the State. In addition, Hecla holds a lease on the Silver Cable mine, east of Mullan, which is producing about 80 tons of ore a day, together with about 1,000 tons of zinc mill feed per day from a 2,000,000-ton tailings deposit near Osburn. The company also owns control of Polaris Mining Co., one of those possessing a part interest in the Chester vein, and is a third owner in the Resurrection mine, near Denver, Colo. The company's latest mining venture is at the Blue Moon property, near Hornitos, Calif., where it is mining a zinc orebody.

▶ Two old, abandoned mines near the town of Arco, Idaho, have recently been reopened by Edward L. Levine and associates of Spokane, Wash., who are working about 30 men at the two properties. Reporting on the development, Levine says that production figures since July, 1943, when operations were started, show that approximately 683,650 lb. of zinc, 376,200 lb. of lead, and 20,340 oz. of silver have been refined from the ores mined during 1943. Daily output from the two properties is about 50 tons, which is shipped to Salt Lake smelters.

▶ The Lucky Friday Silver-Lead Mining Co. has opened a vein of commercial grade ore 16 ft. wide on the 800-ft. level of the mine, which is just outside the city limits of Mullan, in the eastern end of the Coeur d'Alene district. From the 300, 500, and 600 levels the company has shipped ore which has brought net smelter returns of $152,405.74, or enough to finance the entire prospecting development down to the present level, including equipment and original purchase price of $15,000 for the property. Ore shipments from the property have been made in about 1,000-ton lots, and after treatment at the Golconda mill, each has produced a car of lead and a car of zinc concentrates, which have brought combined returns of around $15,000, without counting premium payments. The lead concentrates usually carry over 400 oz. in silver.

▶ A few months ago, Sidney Mining Co. decided to reopen and prospect their mine in the Pine Creek section of the Coeur d'Alene district, in an effort to locate more ore. The company levied an assessment for this purpose, but the money was never used, because new development work opened an orebody 14 ft. wide with good values in zinc and lead. From Oct. 1 to Dec. 20 last year, $51,871 worth of ore was shipped. The company has recently completed a 50-ton milling plant on the property.

▶ In declaring its initial dividend for 1944, Bunker Hill & Sullivan M. & C. Co. cut its dividend rate from 25c. to 12½c. a share, making the first quarterly dividend for the year $163,500 instead of the usual $327,000. The dividend is payable March 2 to stockholders of record Feb. 2. This payment brings the company's total dividend record to $58,750,741. The reason given for the present cut is uncertainty regarding excess profits and other federal taxes.

WASHINGTON

Develop copper-silver mine near Chewelah — Study light-metal markets to aid Northwest

▶ Conrad Wolfle, who was operating the United Copper mine, near Chewelah, more than 30 years ago, has begun development of a group of copper-silver properties on Eagle Hill, in that district. The United Copper is the nucleus. To this he has added the Chinto, formerly known as the

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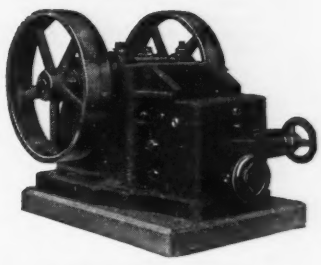

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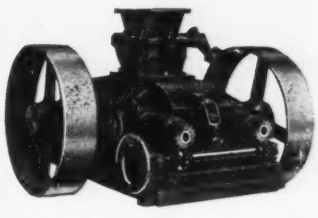

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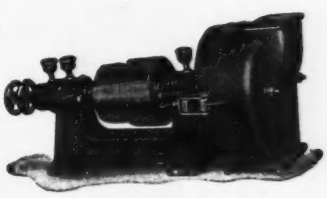

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Washington *(continued)*

Amazon, which he has acquired from the Oppenheimer estate for $15,000, and the Independence-Keystone, which he has secured from Albert I. Kulzer and associates. There are 240 acres in the United Copper group and several claims in each of the other two. Wolfle has given a contract to E. M. Spedden to reopen the No. 1 tunnel in the United Copper, and he has a milling capacity for about 100 tons a day, which he expects to increase. In his earlier work Mr. Wolfle opened one tunnel for a depth of 1,400 ft. and took out high-grade silver-copper ore. The No. 2 tunnel is in 4,220 ft. From these workings he says he took out concentrates which brought $2,500,000. He claims there is one block of ore containing 140,000 tons.

▶ The U. S. Bureau of Mines reports that it has added 9,000,000 tons of zinc-lead ore to reserves in the Metaline district. Earlier exploration in this district by private corporations revealed 3,000,000 tons. The Bureau, since February, 1943, has put down 10,000 ft. of drilling, and reports that the core samples show that the average metal content is about 6 percent, with zinc predominating.

▶ H. Louis Schermerhorn, president of Grandview Mines Co., reports that the company is prepared to pay a dividend this spring of 1c. a share and has set aside $29,997.16, the amount necessary to make this disbursement. This company's property is in the Metaline district and is leased to American Zinc, Lead & Smelting Co., which operates it. American Zinc has bought the Grandview mill and in the last year paid $11,891 on this purchase. Grandview has no debts and reports cash on hand on Jan. 1 in excess of $30,000.

▶ Silver Crescent, Inc., with headquarters in Spokane, reports that its assets total $888,784.87 and its liabilities $226,747.69. The company's chief operation at present is in Idaho, with other holdings in Montana. Guy Riegel, of Spokane, is president.

▶ Markets in the Pacific Northwest will have to be developed to keep the light-metals plants in Spokane, and elsewhere in Washington, in operation, A. A. Kearney, managing engineer of Inland Empire Industrial Research, Inc., told a conference of mining men in Spokane in February. He said the picture for the future is encouraging and urged business men to work for an increase of new industries to use these metals. At a three-state conference in the same month in Spokane, E. Fritz Slade, of the First National Bank of Portland, was made chairman of the new executive committee to promote light-metal plant developments. The committee will work for the retention of the aluminum and magnesium plants already established in the Pacific Northwest.

▶ At a recent meeting of the Inland Relations Committee of the Spokane Chamber of Commerce, several representatives from Chewelah spoke of the activities of Northwest Magnesite Co. there. They said 500 men are employed and the com-

any is producing twice as much magnesite as before the war.

The U. S. Bureau of Mines reports that it has completed the drilling of many shallow holes in clay deposits south of Dishman, Wash., and is now waiting for assays that will indicate the suitability of this clay for production of alumina. The Bureau reports samples of high-alumina clay deposits in King County. It reports the mineral content of the specimens as kaolinite, boehmite, and gibbsite.

The manganese division of Sunshine Mining Co. reports that it is taking out about 600 tons of manganese a month at its Crescent Lake property, on the Olympic Peninsula. The ore goes to Metals Reserve Corp. and some of it is said to be of the highest grade.

ARKANSAS

Hendricks tests new manganese concentrator — Open-pit mine planned near Mt. Pleasant

Mining operations in the Batesville-Cushman manganese field are expanding slowly on a conservative basis. Notwithstanding some bad winter weather which affected mining operations, the production for January increased to approximately 1,555 tons. New washing and concentrating plants and the demand for low-grade are responsible for the increase.

Hendricks Mining & Milling Co., operating the Polk Southard, Southern Hill, and other properties in the Cushman area, made its first trial run on the new plant on Jan. 29 and produced 8 tons of high-grade concentrate. Alvin Hendricks is manager, George Weigart, engineer, and Joe Jeffcoat, construction superintendent. Their main office is in Batesville. Output of the plant is expected to reach approximately 1½ tons of concentrate an hour, and it is now operating on an eight-hour shift. Manganese content of the concentrate produced averages about 50 percent. The crude ore is a residual clay from the Fernvale lime that carries disseminated high-grade oxide. The plant will handle approximately 100 tons of crude an hour.

Walter H. Denison Manganese Co., of Cushman, was the largest producer in the field in January. Total production ran approximately 900 tons, 750 tons of which was low grade and 150 tons high grade. The high grade was purchased by Metals Reserve buying depot, at Batesville, and the low grade went direct to the furnaces. The high grade came from the Ozark property and the low grade from properties on Cave Creek, where a washer in operation.

Lou Peterson, of Cushman, who is operating the Turner property in the Cushman area, got into production late in January, and turned out 10 tons of high grade. Two shaft mines are now in production, and he is sinking a third. He will also start construction of a washing plant soon.

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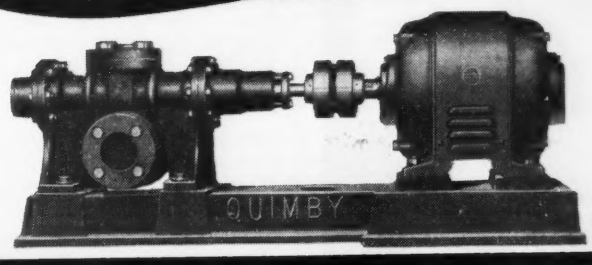

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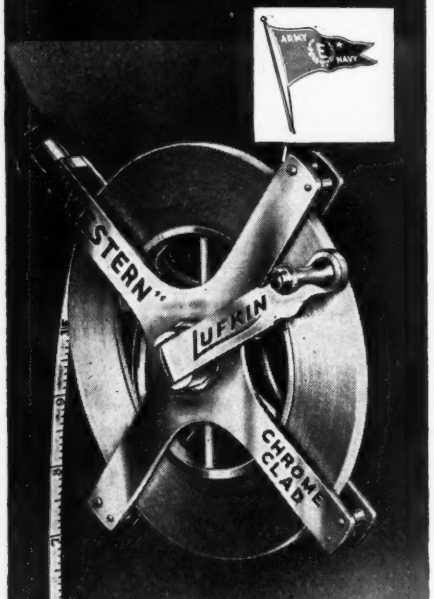

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Arkansas *(continued)*

Batesville, Ark., operating the Bill Chin, in the Cave Creek area, produced 175 tons of medium hard in January. Besides their long tunnel, which is still in good ore, they have sunk four new shafts 80 ft. deep, all of which are now in good deposits of low grade. They will have their new sintering plant at Pfeiffer in production in a few weeks. Their rotary kiln has just arrived and will be installed in the plant as soon as possible.

▶ Stanley Bourne and Ernest Stroud, of Batesville, operating the Austin property near Mt. Pleasant, in Izard County, will start open-pit mining soon. They have been closed for several weeks but will be in operation again in February. They have proved up one of the largest deposits of pyrolusite ever discovered in the field, but have numerous obstacles to overcome before they can get into production. When broken down, pyrolusite is as fine as flour. Most of the ore occurs in clay, and their greatest difficulty is working out a process to concentrate it.

▶ Production in the north Arkansas zinc and lead field ran only one car in January. Only three active operations are reported in the field. Moark Mining Co., C. T. Rabineau in charge of operations, produced one car of high grade silicate of zinc concentrate in January. The company operates the Almy, Red Mill, Gloria, and Jack Pot mines in the zinc area, and keeps a small concentrating plant in steady operation. Another run of high-grade silicate of zinc ore has recently been encountered.

▶ The Bureau of Mines is conducting drilling operations on the Coon Hollow property in the zinc area. Its engineers have completed two holes, with showings of zinc silicate at the silicate horizon, which is about 70 ft. deep. R. B. McElwain, whose office is in Harrison, is in charge of drilling operations. J. R. Thoenen, head of the Little Rock district office, was in the field this week checking operations.

▶ Advance Mining Co., of Chicago, operations in charge of Randall Preve and John Stone, of Harrison, has completed a 70-ft. shaft on its property 3 miles east of Harrison on Crooked Creek. A good run of jack was struck and construction of a concentrating plant was begun. It is hoped to begin operation early in April. The equipment of the plant will consist of an oil engine, a crusher, rolls, and concentrating tables.

IRON COUNTRY

Early opening of navigation in prospect — Short walk-out closes 12 Menominee range mines

▶ Great Lakes shipping veterans are forecasting one of the earliest openings in history of inter-lake navigation after the Coast Guard cutter "Blackthorn" completed the first successful run of the season through Lake Superior on Feb. 16. Coast Guard officers said the run probably was the earliest on record out of Duluth harbor and would mean an "unprecedented early release" of iron ore from the Duluth docks for Eastern blast furnaces. Earliest navigation opening on record was March 26, 1942. Western Lake Superior normally is frozen to a depth of from 8 to 36 in. for 50 to 100 miles out of Duluth, but an unusually mild winter this year kept the lake from freezing deeply.

▶ Among the mining companies carrying on construction work near Hibbing is Inter-State Iron Mining Co., now building a washing plant at the Longyear mine, east of Hibbing. The new plant is designed for three steps of pre-treatment, crushing, screening, and washing. The plant is of timber construction.

▶ Evergreen Mines Co., of Crosby, Minn., is installing a washing plant at its Douglas iron mine at Chisholm, Minn. It will also make improvements at the Greenway and Buckeye plants, at Coleraine. The company is conducting stripping operations at the Douglas, Argonne, Buckeye, Portsmouth-Wearne, Evergreen, Maroco, South Hillcrest, and Martin mines, reflecting operations on both the Mesabi and Cuyuna ranges.

▶ At Davidson No. 3 shaft on the Menominee Range, about 3 miles north of Iron River, Mich., a new fan equipment to supply fresh air underground is being installed. Besides a 12,000 c.f.m. motor-driven fan set up to supply outside air, an air duct opening and damper is arranged to permit 4,000 c.f.m. of heated air to be added as needed to raise the temperature of outside air above freezing. This heated air is supplied by a hot-air furnace of 371,000 B.t.u.-per-hour capacity, equipped with stoker feed for automatic operation. This shaft is connected underground with Davidson No. 1 shaft about a mile to the west.

▶ The 66-in. borehole being sunk at the Carey mine, at Hurley, Wis., reached the 2,000-ft. depth in January and will continue to 2,585 ft., the deepest hole ever sunk by the shot-drill method. When completed, this hole will be stripped and made into the main mine shaft by drawing the rock from the bottom. The Austin Co. was awarded the contract for the new mine brick buildings and is making fast headway on the engine house by hanging large tarpaulins from the erected structural steel and laying bricks in the heated interior. The new Nordberg hoist is on the ground and will be erected on completion of engine house.

▶ As the year 1944 marks the centennial of the discovery of iron ore on the Marquette Range near Negaunee, Mich., this city is endeavoring to celebrate the event by acting as host to delegations from other ranges. Inland Steel Co. plans to assist by undertaking a novel project. It has purchased the old Greenwood furnace, west of Ishpeming, Mich., built during the last year of the Civil War for the production of charcoal iron. This interesting old relic was busy for 10 years, then went into bankruptcy and decay, and now stands as a curio in the woods not far from Inland Steel Co.'s Greenwood mine.

This company not only plans on restoring the furnace but hopes to make a cast of iron during this iron-ore centenary year.

▶ The Eureka mine of Castile Mining Co., at Ramsey, Mich., is raising its main shaft from the 30th to the 29th level through a winze. The vertical depth of the shaft will be 3,502 ft., the deepest shaft on the Gogebic Range.

▶ It has been reported by Representative Patton, of Texas, that the Defence Plant Corp. has given final approval to plan for erection of a 3¼ million dollar charcoal iron-ore blast furnace works at Rusk, Tex. One blast furnace of the two to be moved is now idle at Wells, Mich. Chemical byproducts resulting from the use of charcoal will be almost as important as the production of pig iron in the new location.

▶ About 1,700 miners affiliated with the CIO union ended a walk-out on Feb. 13 that had left 12 mines on the Menominee Range idle for three days. The strike started at the Sherwood mine of Inland Steel Co., where 120 men walked out in protest after a man was fatally injured. The union claims the men should work in pairs in certain types of underground operations; the operators claim it is not necessary. Decision to resume work was reached at a meeting of the miners on Feb. 12, and the issue was left to arbitration by a committee of three: a representative from the union, one from the company, and a neutral third to be selected by the other two.

▶ The Zimmerman mine on the Menominee Range, operated by M. A. Hanna Co. until September, 1943, has been taken over by Pickands, Mather & Co. and will be used to mine out the DeGrasse reserves to the north and east of the shaft. Opening this mine will close down the Bengal mine of the P. M. Co. further north, and the Bengal employees and miners will be shifted to the Zimmerman mine.

TRI-STATE

Uncertainty regarding future cuts new development—F. W. Evans now mining at Walker Shaft

▶ New activity in the Tri-State mining field is nearly at a standstill, awaiting clarification of the government's policy with respect to premium production of zinc, to stockpiling, and to tariffs and imports of metals. Regardless of these factors, the local mining industry continues to produce nearly 8,000 tons of high-grade zinc concentrates weekly. Mechanization has done much to make this possible by offsetting the shortage of experienced miners, who still are being taken by the draft.

▶ Tri-State Zinc, Inc., is completing a 50-ton-an-hour mill on the Weyman land, in the Short Creek bottoms, a mile west of Galena and on the north side of the creek. The mill is being constructed primarily for the re-treatment of sand

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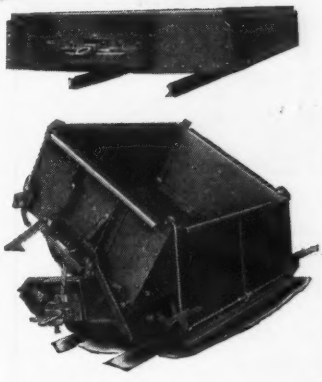

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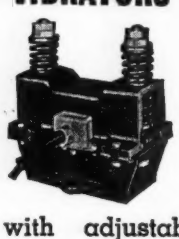

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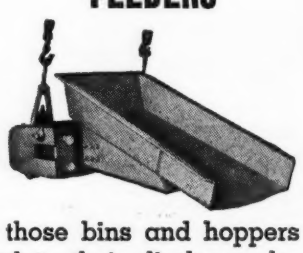

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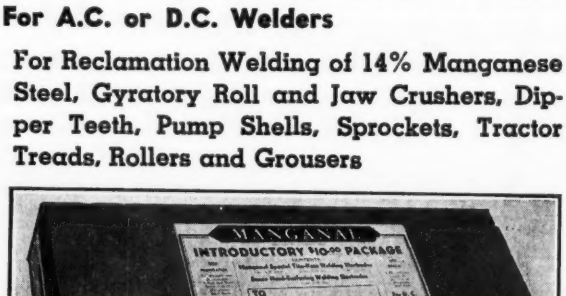

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Tri-State *(continued)*

and gravel from the creek bed, which is composed of zinc-lead minerals, mostly zinc, washed down the creek from Galena mines over a period of several decades. The company expects to treat between 500,000 and 600,000 tons of this material, according to Victor C. Allen, of Joplin, general superintendent. The mill will not include jigs or a flotation plant. Screens and rolls will be used in sizing, and 15 sludge tables will be installed for concentration. A few small chat piles in the Galena area will be treated. Milling operations are scheduled to get under way around the middle of March, Allen said.

▶ Eagle-Picher Mining & Smelting Co., American Zinc, Lead & Smelting Co., and Oronogo Mutual Mining Co. are constructing an underground bulkhead, 100 ft. south of the Fenix & Sons No. 5 shaft, to block off the underground inflow of water from the old Webb City mining area to the south and east. The bulkhead will be about 150 ft. wide, 8 ft. high, and several feet thick. Churn-drill holes were put down from the surface for passing concrete aggregate down to the bulkhead site. The installation will lessen the expense of pumping the inflow of water from the Webb City area, and will lessen the amount of water to be pumped in the event of other floods such as the one that occurred last May. The underground wall will block off the water from entering the F. & M. Mining Co.'s La Tosca mines, the Fenix & Sons' Waring workings, and the Oronogo Mutual's property, the famous open-pit zinc-lead mine —all of which are at Oronogo.

▶ F. W. Evans Mines has begun mine operations at the Walker shaft on the McBee-Martin boundary line, a half mile north of Smithfield, according to F. W. Evans, of Joplin. The shaft, which was sunk more than a year ago by Barney Walker, of Joplin, and associates, was deepened 5 ft. by Evans to the 150-ft. level. Two 8-in. turbine pumps, powered by diesel engines, were used to dewater the mine and handle the inflow. Under the supervision of Sam Ashe, the company is reopening two old Kansas Explorations shafts in the Smithfield area, one on the McBee land and the other on the Martin. The old Black Cat shaft, southeast of the Walker shaft, also is being reopened, and the company is sinking a new shaft northeast of the Walker on the Martin land. An electric power line is being extended about 5 miles to furnish power for the expanded operations. New derricks have been built at all the shafts, with the exception of the old Kansas Explorations shaft on the western part of the McBee tract, which has been repaired preparatory to the building of a derrick and the installation of hoisting equipment.

▶ Jesse Worley, of Baxter Springs, who has been operating a tailings re-treatment plant in the north end of the old New Blue Mound mill, north of Picher, in Kansas, has converted the south end of the mill for the treatment of custom ore. An incline tramway has been built from the southwest to the mill hopper. Worley is treating ore from the Mary C. Mining

Co.'s mine on the old Bingham lease, at Picher, which was opened with the sinking of a new shaft last year by L. Myers and John Hicks, both of Picher.

▶ James M. Osborne, of Miami Route No. 1, and associates have reopened a shaft on the Bob White lease, south of the Eagle-Picher Bird Dog mill west of Picher. Ore is being trucked to Eagle-Picher mill for treatment.

▶ R. M. Clark, veteran Tri-State mine operator, has purchased milling equipment in the district for shipment to Hudspeth County, Tex., where he plans to erect a zinc-lead concentration plant at the old Bonanza mine. The mill, of all-steel construction, will have a capacity of 15 tons an hour and will be used first to treat a 100,000-ton dump pile at the old mine property, which was purchased recently from the Southwest Mining Co., Inc. The Bonanza mine property, featuring an east-west ore outcropping across the south part of a section of land acquired by Clark, was discovered in 1880 and has been worked for lead and silver intermittently. There are three shafts on the property, the deepest being 400 ft. in depth and the other two, 300 and 200 ft., respectively. Clark plans to reopen the shafts after treating the ore in the dumps, which average about 6 percent zinc and 2 percent lead, he said.

ALASKA

U.S.G.S. maps Costello Creek coal basin — Carnegie Institute opens field station in Fairbanks

The Caamano antimony deposit on Cleveland Peninsula, in southeastern Alaska, is estimated by the U. S. Geological Survey to contain 45 tons of measured ore and possibly 25 tons of indicated ore. Stibnite is estimated to constitute 70 percent of this tonnage. The deposit was examined in the late summer of 1942 by G. D. Robinson, of the Survey.

▶ The Costello Creek coal basin has been mapped by the U. S. Geological Survey. Its area is about seven square miles, and it is situated on the southern flank of the Alaska Range, 11 miles northwest of Colorado Station on the Alaska Railroad. The coal is sub-bituminous in a faulted and folded sequence of beds of Tertiary sandstone, siltstone, conglomerate, and claystone. Some beds are as much as 9 ft. thick, but disappear within a few hundred feet. Glacial outwash of probable Pleistocene age overlies the Tertiary. In connection with this work the U. S. Bureau of Mines did some diamond drilling and trenching.

▶ Classes were held for two weeks in January and February in mine extension courses at Fort Richardson by Howard G. Wilcox, dean of the School of Mines at the University of Alaska. The extension work covered mineral deposits, mine operations in the Territory, geology for prospectors, mineral identification, and the laws relating to the staking of mining claims.

▶ Robert S. Sanford, District Engineer for the U. S. Bureau of Mines, told the Alaska Miners' Association in Seattle in February that Bureau work in Alaska will be continued this year but will not be resumed until March or April. He said authority has been granted for further work at the Chrome Queen mine, near Seldovia, a substantial producer last year. He said, also, that there were encouraging indications of mercury in the Kuskokwim, Flat, Crooked Creek, Dillingham, and Hoholitna districts as well as elsewhere in the Territory. Examinations in the Bering Sea area showed tin properties which he believed would have been made productive if the proposal to peg the tin price at a dollar a pound had been adopted. Mr. Sanford believes there are vast areas in the Territory which contain unexplored mineral deposits.

▶ John Bufvers, of Ketchikan, has been prospecting for iron ore in the old Mount Andrew copper mine, on Kasaan Pen, Prince of Wales Island. Last fall he relocated the McLeod Bay Gold Quartz on Dahl Island, where he says there are indications of a big tonnage. He reports that vein deposits are several hundred feet wide and traceable for several claim lengths. Theodore Chapin examined this ground for the U.S.G.S. nearly 30 years ago, and at that time it is said ore samples were obtained which ran more than $3 to the ton in gold.

▶ The Territorial Department of Mines, paid $53,500 last year for antimony, mercury, tin, and tungsten for the government's stockpile at Fairbanks. Metals Reserve Co., which takes this ore, has extended the purchase period to Dec. 31, 1944, and expects substantial deliveries within that period.

▶ The University of Alaska has leased to the Carnegie Institute of Washington 250,000 sq.ft. near the University campus, as a site for a field station. Stuart L. Steaton, of the Carnegie staff, has eight assistants conducting geophysical research at the station. The study includes correlation of solar terrestial phenomena and cyclic variations in the upper atmosphere.

CANADA

Government buys out Eldorado radium mine—Pinchi Lake and Takla still producing mercury

▶ Canadian and English representatives of the mining industry have held the first of a series of conferences for the purpose of working out some practical solution of postwar problems concerning surplus metal stocks. An effort is being made to lay out a marketing program, independent of the United States, for disposing of accumulations of war materials with the advent of peace. Problems connected with opening up new markets for the metal surplus are being systematically investigated. Cautioned by the tariff wall against metal imports that was erected by the United States during the depression, an effort is being made to work out an Empire mar-

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Canada *(continued)*

keting program that will be supported by cartels or other trade controls. Stockpiles and surplus production present major problems that demand careful study by mine operators within the Empire.

▶ On Jan. 28, Munitions Minister Howe advised the House of Commons that the radium mine at Great Bear Lake, Northwest Territories, had been taken over from the owners, Eldorado Mining & Refining, by the federal government for the purpose of securing more effective operation under war conditions. Properties secured include the refinery at Port Hope, Ontario, and the private air and water transportation facilities. Both assets and liabilities have been transferred to government control, and the mine and technical staff will continue as formerly. Payment to shareholders is being made at the rate of $1.35 a share, the market price in effect when negotiations were concluded. Gunnar Gold Mines has taken over the original Eldorado gold property in northern Manitoba. This transaction makes Ottawa responsible for a property payment amounting to $5,271,812.

▶ The Nova Scotia barite property of Canadian Industrial Minerals, controlled by Springer Sturgeon Gold Mines, is being diamond drilled to test an assumed extension of the main deposit. An estimated 1,500,000 tons of high-grade barite was formerly indicated by a series of drill holes, and it is now intended to test the deposit at lower horizons. Present output amounts to more than 30,000 tons annually, chiefly for use in oil well drilling in South America.

QUEBEC

▶ The plant of the Aluminum Company of Canada, on the Saguenay River at Arvida, is under contract until June, 1945, to supply the United States with 600,000,000 lb. of aluminum a year. This metal is to be made available in repayment of the $67,000,000 advanced for plant construction. Philip D. Wilson, director of the Aluminum Division of WPB, commented that cancellation of this contract will require six months' notice and added, "personally, I think we are lucky to have had the use of foreign power, labor, and bauxite."

▶ The Duprat Township property of Golconda Mines and the adjoining holdings of Despina Mines have been acquired under option by Ventures, Ltd. A new company is being formed to take over and develop these holdings, along with the adjoining MacDougall claims. The latter was the original ground to be held in northwestern Quebec by Thayer Linsley, before Ventures had been organized. The property adjoins Waite Amulet Mines on the southwest. Geophysical exploration in this area has indicated promise of developing ore under conditions similar to those on the Waite Amulet holdings. Finances for the proposed program are to be supplied by Ventures.

▶ The property of O'Leary Malartic Mines, west of Golconda Mines, in Duprat, and the adjoining claims in Beauchastel Township, have been taken over by Elder Gold Mines. A program of diamond drilling and geophysical exploration has been announced, the purpose being to extend the 700-ft. ore zone that was located by drilling several years ago. Deep overburden makes surface work on these claims impractical.

▶ At New Calumet Mines, on the Ottawa River in Pontiac County, ore reserves at the end of last September totaled 1,016,022 tons. In the annual report the manager, J. M. Cunningham-Dunlap, states that positive ore above the 600-ft. level has an average content of 9.45 percent zinc, 3.01 percent lead, 6.29 oz. silver, and 0.047 oz. gold per ton. In his review of operations from the time milling was started last September, the president, M. A. Thomson, stated that production had been advanced to 500 tons daily and ore grade was being maintained. Zinc concentrates are being shipped under a contract with the Metals Reserve Co. for 70,000 tons of lead-zinc concentrates. Payments are being made for lead, gold, and silver concentrates, which are being stored on the property. Last October the shaft was deepened to 745 ft., following development on the 200- and 300-ft. levels.

ONTARIO

▶ The mining and milling of a sandstone deposit near Kingston is proposed by Lapa Cadillac Gold Mines. The president, Dennison Denny, reports that development of the Quebec gold property came to an end last May after all known

ore had been mined. Dr. G. F. Flaherty, consulting geologist, reported that a detailed survey of the underground working indicated that no further exploratory work appeared to be warranted. Though it was intended to secure another gold property, the operating staff is being retained and operations in the immediate future are to be confined to the production of silica sand and various silica products. Total gold output from the Cadillac property amounted to $1,785,975 and $72,957 cash on hand.

▶ Depth development is being advanced at Paymaster Consolidated Gold Mines, where four levels are being opened below the 2,200-ft. horizon and a new block of levels is to be developed down to 3,000 ft. In the No. 5 shaft section, a winze has been put down to 4,000 ft., and it is proposed to run a drift at this lower horizon into the western part of the property. In the block of ground from 2,200 ft. down to 2,575 ft. the vein sections that have so far been exposed have a combined length of 3,634 ft. and widths averaging better than 53 in. The average gold content is reported at 0.26 oz. per ton. Labor shortages have delayed progress on this program, and have forced a cut in output from the 600-ton capacity mill of more than 200 tons a day.

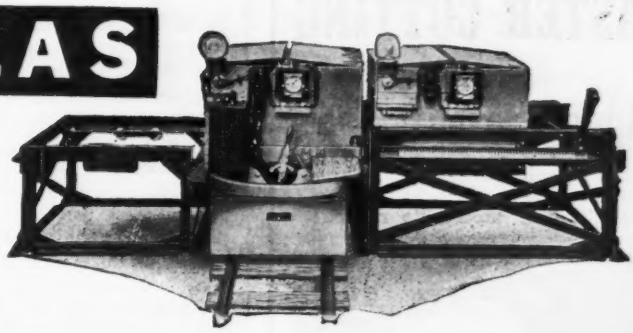
▶ Last year production at Teck-Hughes Gold Mines averaged $12.42 a ton, for a total of $1,250,854, compared with output in 1942 amounting to $1,365,513, an average of $14,63 a ton. All ore hoisted has come from above the 20th level, below which no work has been attempted for the last two years, because of inadequate labor. The mill rate continues to average 275 to 300 tons a day, compared with the capacity of equipment installed in 1932 of 1,350 tons. At the present low tonnage, production is expected to be continued for many years. The operating profit in 1943 was $609,409 at the Teck-Hughes property; income from the subsidiary Lamaque Mines, in Quebec, amounted to $1,013,691. Dr. David L. H. Forbes is president and general manager and J. G. McMillan is general superintendent.

BRITISH COLUMBIA

▶ Despite the acute shortage of labor and the province-wide strike of the United Mine Workers of America last fall, coal production in British Columbia during the past year was only 132,172 tons less than in 1942. Total output for 1943, was 1,805,986 long tons. During the year the Elk River colliery of The Crow's Nest Pass Coal Co., Ltd., was opened, and the Corbin colliery, idle for the past ten years, was reopened by Consolidated Mining & Smelting Co. of Canada, Ltd. There has been a marked expansion of coal mining in the Telkwa district of northern British Columbia, and production has begun in the Peace River Block. Chief casualty of the year was the closing of the Bromley Vale colliery by Granby Consolidated Mining, Smelting & Power Co., Ltd.

▶ To date neither of British Columbia's principal mercury producers have been affected by the recent announcement that

ATLAS



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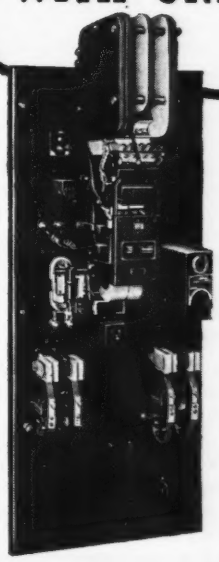

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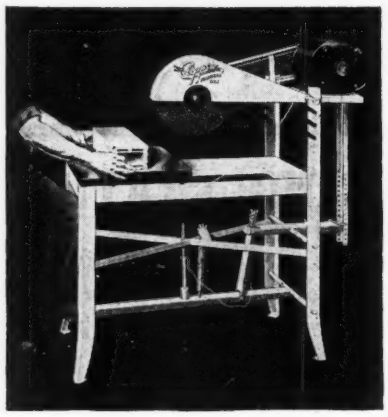

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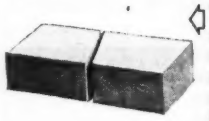

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Canada *(continued)*

Metal Reserve Co. was terminating all contracts for the purchase of quicksilver. The contract with Consolidated M. & S. Co., operator of the Pinchi Lake property, largest producer in the hemisphere, was terminated last fall, and since that time production has been absorbed by eastern Canadian interests and the British government. A part of the output is being stockpiled. Bralorne Mines, Ltd., which started production at the Takla mercury mine only last November, has not been notified of any change in its arrangements with the U. S. government's agency.

▶ John Hart, Premier of British Columbia, has announced in the Legislature selection of the Pine Pass route for construction of a connecting link between existing British Columbia roads and the Alaska Highway. Although the proposed route will open promising deposits of high-grade coal in the Peace River Block, and encourage prospecting for oil, its selection is a disappointment to mining men in this Province, for it was hoped that a more westerly approach would have been chosen —one which would have provided access to the Omineca and Coast batholiths. However, the proposed road follows the Rocky Mountain Trench as far as Finlay Forks, and this will mean construction of about one-third of the "B" route, which would meet the Alaska Highway at Watson Lake in the Yukon Territory. The selection of the Pine Pass route is at variance with the suggestion of the Pacific Northwest Trade Association, which is backing the "B" route. The Provincial government is prepared to spend $6,000,000 on this project.

▶ Milling operations of Hedley Mascot Gold Mines, Ltd., which were suspended at the end of September last, will be resumed in March if sufficient labor is available, according to an announcement by V. J. Creeden, secretary manager. During the shutdown, all hands have been concentrated on development work, which had fallen behind as a result of the labor shortage. Fifty men will be required to provide sufficient help to maintain normal operation. The company has taken an option on the Good Hope group of mineral claims, also in the Osoyoos district, and only 6 or 7 miles distant from the Mascot property. Examination of outcrops by the company's geologists has revealed the presence of gold telluride ore. An adjoining group has been acquired by Pioneer Gold Mines of B. C., Ltd.

▶ Reco Mountain Base Metal Mines, Ltd., Gold Frontier subsidiary, operating the Noble Five-Deadman-Surprise groups, in the Slocan district, has been compelled to remodel the Noble Five mill after disappointing recovery during September and October. As a result, zinc recovery was materially improved in November. Lead and zinc concentrates are shipped to Metals Reserve Co. under contract.

YUKON TERRITORY

▶ The Lone Star gold group, near Dawson, previously reported to be under development by United States' interests, has been acquired on option by Yukon Consolidated Gold Corp., Ltd. The property is near the company's extensive placer holdings, and can be developed by Yukon Consolidated at less expense than by others who might lack plant, equipment, or power. W. H. S. McFarland, general manager, states that development will be undertaken as soon as the necessary labor can be found.

▶ During 1943, placer gold valued at $1,353,243 was produced by Yukon Consolidated. Shareholders have been advised as follows by C. E. McLeod, secretary: "Although all departments of the operations will suffer a further curtailment in 1944, it may be said that the general outlook is brighter than it was at the end of 1942, and it now appears likely that the complete shutdown feared last year on account of lack of labor can be avoided. However, mining on a scale large enough to produce distributable profits can hardly be expected until after the close of hostilities. The company's financial position remains strong, and after payment of the sinking-fund instalment in 1943 the obligation on debentures is reduced to $395,000. In view of these factors your directors consider that a single dividend of 6 percent of profits for the year 1942 is justified. A dividend of 6c. per share has, accordingly, been declared, subject to the approval of the Foreign Exchange Control Board, payable on March 15 next to shareholders of record at the close of business in Feb. 15."

▶ A resolution has been passed by the British Columbia and Yukon Chamber of Mines recommending that the Yukon mining laws be amended to permit the staking of eight mineral claims in each area of a radius of 10 miles. It is claimed that the present law limiting the staking to one mineral claim does not cover mineral discoveries properly and that it discourages prospectors and operators.

▶ Several outfits are developing quartz claims this winter on Galena and Keno hills, near Keno City. Sandy MacPherson and E. Bjonnes are working the Silver King, Charles Brefalt and "Home Brew" Pete are working the Elsa, Bobby Greaves is working the Arctic, and Billy Williams the Sadie.

MEXICO

Pessimism grows regarding future Mexican industry — Large claim filed against La Consolidada

▶ Leaders of Mexican mining industry met during the middle of February to consider ways and means of combating what many of them feel will be postwar conditions inimical to mining. Lending weight to the industry's pessimism was a recent price break in several industrial commodities, particularly mercury. Mining of gold and silver is the only branch of the industry in Mexico that is regarded as secure, and even this activity is hindered by difficulty in obtaining equipment. The Mining Chamber of Mexico and the Mexican

Mining Association are among the groups now seeking means of coping with any adverse situations that may develop as the war comes to an end.

▶ A further depressing note was sounded late in February when the Banco de Mexico, in its annual report for 1943, declared that industrialization of Mexico had been retarded indefinitely by the repercussions of the war on world economy. In particular, the report stated, decreasing demand for minerals and other raw materials will cause difficulties in the future. To protect Mexican industries and workers, the Bank suggests restrictions on the importation of luxury articles and any manufactured goods that might compete with those produced in Mexico. The report listed Mexico's accomplishments in aiding the war effort of the United Nations, both with contributions of raw materials and of men. With regard to trade, the report showed a favorable trade balance for Mexico in 1943; exports were $213,900,000, imports were $173,600,000, but it was added that imports had once again surpassed exports in the closing months of 1943. Minerals made up 27 percent of exports in 1943, a drop of 8 percent since 1942.

▶ Chinese interests have become active in tungsten mining and exporting in northern Sonora. Wah Chang Trading Co. leads in this endeavor through its Mexican subsidiary, Tungsteno Mexicano. Purchase of tungsten ores and concentrates has been carried on for the past 15 months from Tungsteno Mexicano's headquarters in the Banco de Nogales Building, Nogales, Sonora.

▶ State governments have no right to tax mining enterprises, according to a decision of the Federal Supreme Court in granting an injunction to Cia. Estanera Mexicana restraining the State of Durango from taxing the company 4 percent of the value of its tin and mercury output. Only the federal government, says the Court, may tax mining companies.

▶ Keith Kennedy Koffroth, of Mexico City, is developing a mercury prospect at Huilipan, about 5 miles from Iguala, Guerrero. Koffroth is currently employing about 30 men at the property and reports good prospects.

▶ The first unit of the iron and steel works, Altos Hornos de Mexico, S. A., Monclova, Coahuila, will be in service in April, according to General A. Lopez Padilla, governor of Coahuila. General Abelardo L. Rodriguez, a former president of Mexico, is chairman of the board of this American-Mexican enterprise.

▶ The largest claim yet filed with the central committee of vigilance, charged with enforcing the recent mandatory nation-wide pay increase, has been brought for 500,000 pesos ($105,000) by the national miners union against La Consolidada, S. A., pioneer iron and steel works, founded more than 30 years ago by American interests in Piedras Negras, Coahuila, and Mexico City. The union claims that the company has not complied with the pay-increase law since it was decreed on Oct. 1, 1943, and asks the above amount as retroactive wages.

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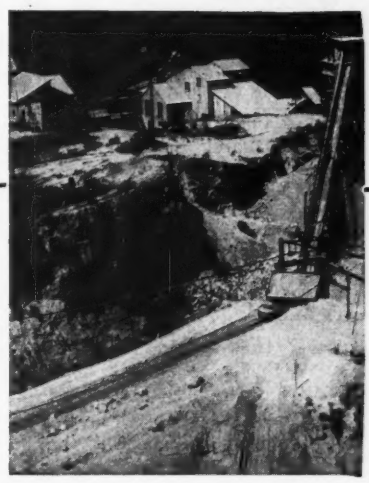

(Explanation of Picture) Conglomerate blasted from the face of a long bank, is gathered by ¾ cu. yd. Sauerman Scraper and hauled to inclined conveyor feeding a processing plant. The scraper unit is operated by one man, consumes about 3½ gal. of gasoline per hour and handles 30 tons of material hourly.

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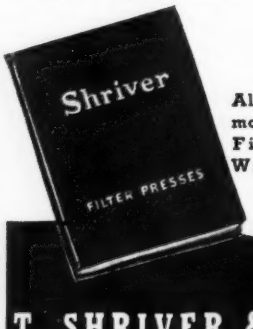

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PERU

Volcan mine developed — Coal now being exported—Peru Molibdeno plans increased production

▶ The Volcan mine of Volcan Mining Co., in the central Sierra at an elevation of over 16,000 ft., is now being developed intensively. The ore, which contains lead, copper, and zinc, will be treated at the Mahr concentrator of Cerro de Pasco Copper Corp.

▶ With completion of the railroad from Chimbote to Quiroz and La Limena, which was destroyed by the Huaraz catastrophe in 1942, that region has become Peru's most important producer of anthracite and bituminous coal. With the new loading facilities installed at the port of Chimbote, large amounts of coal are now being shipped abroad, especially to Uruguay and Argentina. Main producers are the Calgada and the Lord mines, which have already exported 10,000 tons, but many other mines are being developed. This is the first time that significant quantities of Peruvian coal have been exported, and the industry seems to have an excellent chance to continue after the war.

▶ Los Incas mine, south of Nazca, which belongs to the Consorcio Minero Peruano, has cut a promising vein in the lower levels, where intensive development has been under way for the past two years. The Consorcio now plans to erect a 350-ton concentrator at Los Incas, built largely with machinery from the now extinct Cia. Minera Nacional. The ore at Los Incas runs about 0.4 oz. gold and 1.5 percent copper.

▶ A group of engineers from Morfit & Co., New York, N. Y., recently left Peru after a month in the country spent studying the opportunities for a steel industry there. The firm of H. A. Brassert & Co. made a similar investigation during 1941 and 1942, and the Morfit group, sent down by the Export-Import Bank, will have the final say on the matter.

▶ The Convento mine, formerly the Chala, also part of the Consorcio Minero Peruano, is now installing a 150-ton milling plant. Reserves at Convento are approximately 200,000 tons of ore containing 0.3 oz. gold per ton.

▶ The concentrator belonging to Northern Peru Mining & Smelting Co., in the town of Samne, inland from Trujillo, resumed operations in January. The mill was installed at Samne in 1923, but mill feed, made up of ore from local mines under lease to Northern Peru, has not been sufficient to keep the mill going regularly. The last time it operated was in 1938. At present, after some new mines are developed in the Milluachaqui region, about 60 tons per day of silver ores are expected to be available for treatment.

▶ Peru Molibdeno, S. A., which owns the only large molybdenite orebodies in Peru, has lately received from the United States, through a loan made by the OEW, some mining equipment that includes several portable air compressors and a diamond drill. The company plans to increase greatly its production of molybdenum.

BRAZIL

New tungsten area increases production — Sulphide copper ores mined in Rio Grande do Sul

▶ Widely scattered deposits of scheelite were discovered about two years ago in the southern part of Rio Grande do Norte and the northern part of Paraiba, in northeastern Brazil, over an area of about 15,000 sq.km. About 60 prospects are now being developed, and last year production from the region amounted to about 1,000 tons of hand-picked concentrate containing an average of 70 percent WO_3. Scheelite is found in pegmatites in the schistose rocks of the Pre-Cambrian, though so far limestone has proved to be the most favorable host rock. Much of the credit for development of this new mineral district goes to the staffs of the U. S. Purchasing Commission and the Departamento Nacional da Producao Mineral.

▶ This tungsten district is also producing increasing amounts of beryl and tantalite, which go to Metals Reserve Co. Five areas of the district turn out about 35 tons of beryl and 4 tons of tantalite ore per month.

▶ It was reported recently that Cia. Brasileira de Cobre is mining sulphide copper ores from the mines of Camaquam, Seival, Primavera, Cerro dos Martins, Cerro dos Andradas, and Barita, in the Cacapava-Lavras district of Rio Grande do Sul, in southern Brazil. Prospecting was started in 1937 by the Departamento da Producao Mineral with several diamond drill crews, and it is reported that reserves now amount to a million tons of good-grade copper ore. Two flotation and gravity concentration mills have been erected; one at Camaquam, to treat 120 tons daily, and the other, a 60-ton mill, at Seival. The company is also completing a 10-ton-per-day copper smelter in Sao Paulo, about 2,190 km. from the mines. Production of metallic copper is expected to start within six months.

▶ Another mining district recently discovered comprises widely scattered tin placers in an era of about 600 sq.km. in the region of Sao Joao del Rey, in Minas Gerais, in central eastern Brazil. This region underwent a rush of prospecting a few months ago, and more than 50 claims have been staked. Although mining and milling are still done by primitive methods, total production is expected soon to reach 1,000 tons of contained tin. About a dozen small blast furnaces have been erected to smelt the high-grade concentrates obtained in bateas, and tin metal of plus 99.8 percent produced by these smelters is being sold to consumers in Rio de Janeiro and Sao Paulo.

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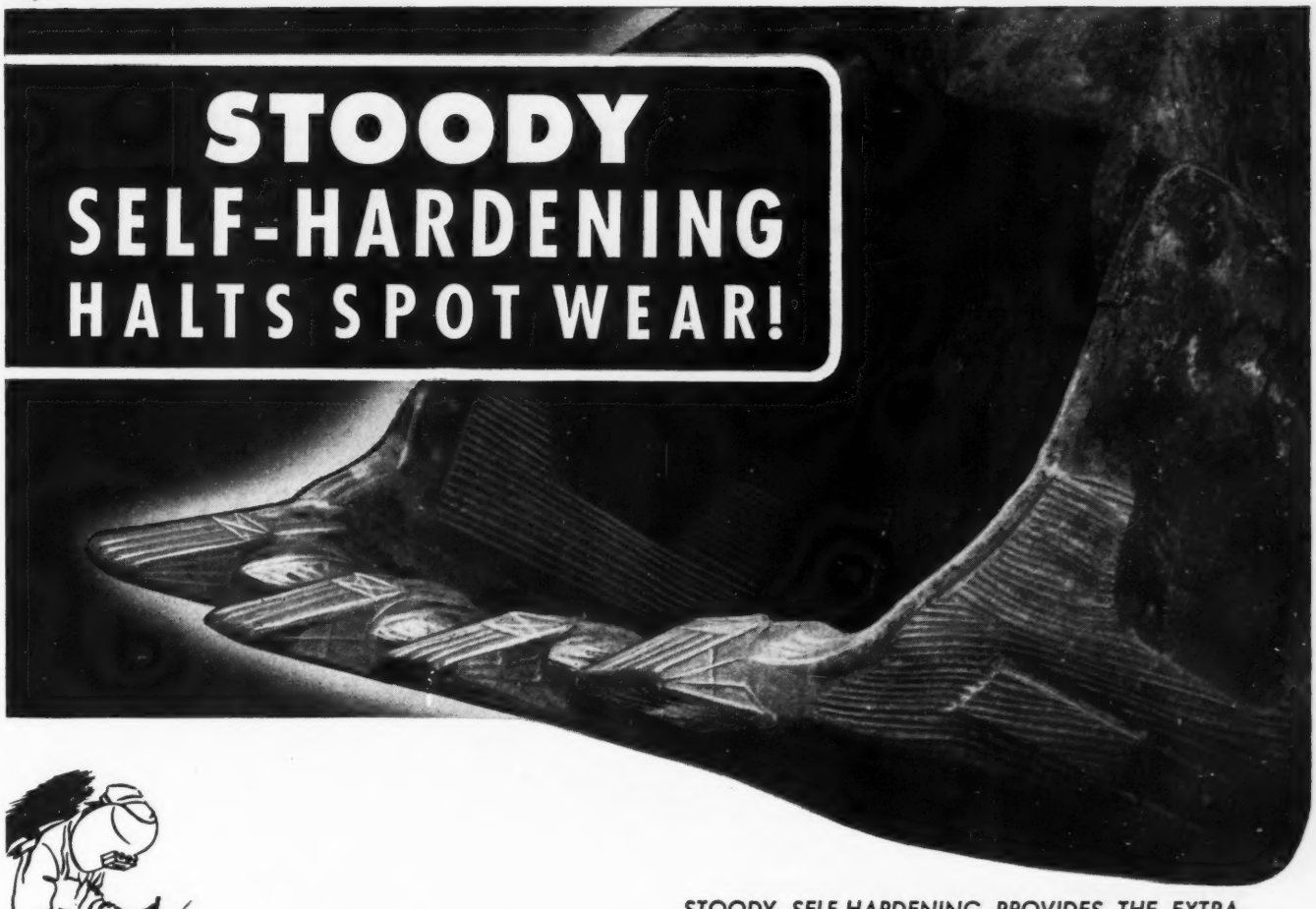

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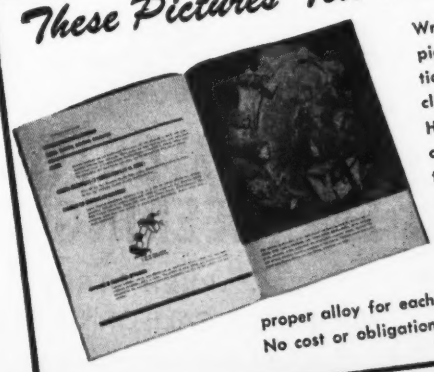

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AUSTRALIA

Boulder Perseverance, Ltd., had good record in 1942—Zinc Corp. improves recovery, but costs rise

▶The annual report of Boulder Perseverance, Ltd., Kalgoorlie, for the year ended Dec., 1942, showed satisfactory results in view of the prevailing difficulties, but the position has deteriorated during 1943. Ore treated in 1942 was 13,962 long tons less than in 1941, and less than half the normal development was carried out owing to insufficient labor. Net profit for the year amounted to £A49,328. Total ore treated was 106,961 long tons having an assay value of 6.478 dwt., a decrease of 0.136 dwt. on the value during the previous period. Despite reduced development, ore reserves were maintained at a satisfactory figure, the estimated quantity of proved, broken, and probable ore being 489,900 tons having a value of 5.7 dwt. gold per ton. Costs were: ore production, 16s. 10d.; development and diamond drilling 3s. 2d.; treatment, 14s. 3d.; other expenses, 1s. 11d.; total, 36s. 4d. per ton. The company's ore is treated by Kalgurli Ore Treatment Co., Ltd., as is that of Kalgoorlie Enterprise Mines, Ltd., which is managed by Boulder Perseverance, Ltd. The recovery obtained was 93.6 percent. Treatment is by fine grinding, flotation, roasting of the flotation concentrate, and cyanidation of the calcine. Residues assayed 0.38 dwt. gold per ton, which was 1s. 10d. higher than in the previous year.

NEW SOUTH WALES

▶Zinc Corporation, Ltd., Broken Hill, has issued the report for the year ended Dec. 31, 1942, which, in accordance with wartime regulations, omits much of the operating data usually included. After providing £220,405 for mining royalty, and taxation in Australia and in England, a net profit of £104,590 was earned, compared with £102,085 in the previous year, the amounts being in British currency. Comment was made at the annual meeting that the company receives no depletion allowance such as is comparatively generously given by the governments of the United States, Canada, and elsewhere. The effect of taxation payments on financial resources is becoming increasingly severely felt in view of the necessity for renewal of plant and buildings at approximately every 15 years or less. The drain on manpower affected output of ore and concentrates. Wages were increased and there were also increases in the prices of stores, which consequently resulted in higher working costs. Pressure to maintain output is adversely affecting development, a factor which must influence future production. It was stated that the mine had responded well to development during the year, and that there is every prospect that it will be able to meet without strain the increased output of the war years. Ore reserves have been maintained. Ore production was over 500,000 tons, and

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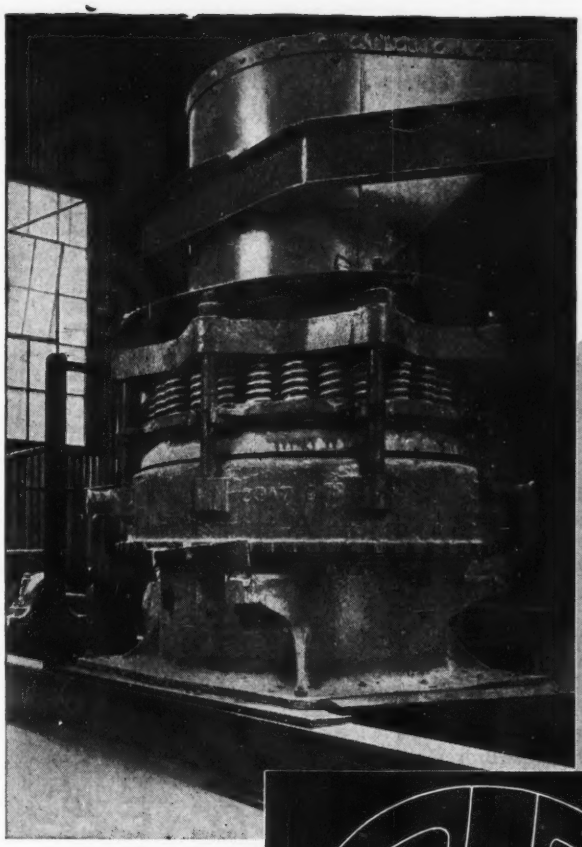
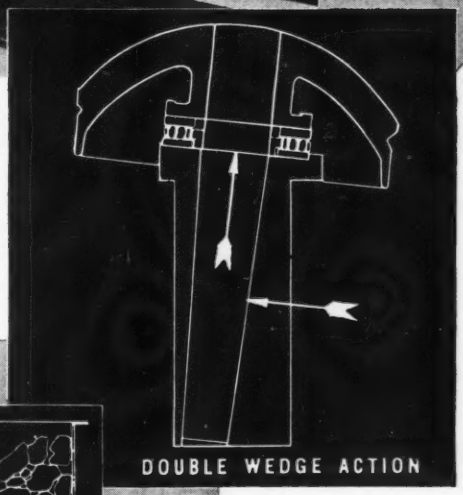


Telsmith Gyrasphere Secondary Crusher is made in 24, 36 and 48 inch sizes, with interchangeable crushing concaves . . . to meet varying size requirements.

The Only SECONDARY CRUSHER WITH THE Double Wedge CRUSHING ACTION



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Working at choke feed, the Telsmith Gyrasphere Secondary Crusher not only turns out an enormous tonnage of more cubical aggregate, but crushes finer, with less trouble, less power, and less upkeep.

In the Gyrasphere, *two forces cooperate to produce the most effective breaking action ever developed in any crushing device.* The head is impelled both by the gyrated shaft and a rotary wedge action, produced by the supporting eccentric and roller thrust bearing. The bronze eccentric sleeves are relieved of most of the load—pressures being diverted downward to the massive roller thrust bearings, which wear evenly and last indefinitely.

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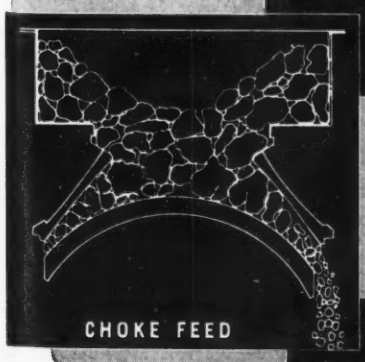

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The Gyrasphere takes an unregulated and unlimited choke feed. That means steady, reliable, economical, effective reduction capacity.

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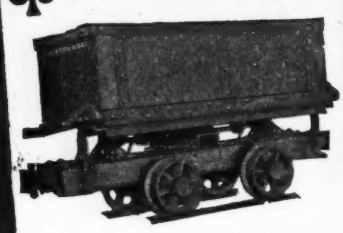
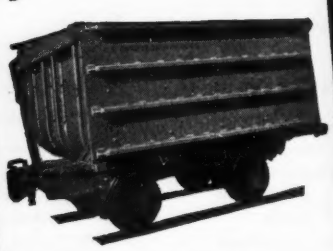
TELSMITH Gyrasphere SECONDARY CRUSHER

CARD CARS



Card Cars are built to stay on the job.

Designed and ruggedly constructed—Card Cars are made to meet your special problems.



Specify Card Cars for "Lowest Cost Per Ton Mile Haul".

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C.S Card Iron Works Co.
Denver, Colorado

Australia *(continued)*

more than 90 percent was mined above No. 14 level (1,960 ft.). Steady improvement in mining practice has led to higher efficiency, which has been obscured by increased wages and stores costs. Metallurgical results have continued to improve, though the high standard attained makes improvement difficult. In the past year the recovery of lead rose from 96.5 per cent to 96.8 per cent and that of silver from 92.9 percent to 93.7 percent. Exploratory and development work in the adjoining New Broken Hill Consolidated property have strongly indicated the continuation of the broad lead lode to the southward.

▶ The mine of New Broken Hill Consolidated, Ltd., adjoins the property of Zinc Corporation, Ltd. on the southern boundary and is managed by that company. When production starts, ore from New Broken Hill will be treated at the mill of Zinc Corporation and work will be carried out through the Corporation's new Main shaft. All development operations have been effected from the workings of the latter mine. As an important factor in the working of both mines, a downcast airway has been sunk on the New Broken Hill leases at a point 1,000 ft. south of the joint boundary. In the year ended Dec. 31, 1942, the report for which has been recently received, the airway was sunk 227 ft. to 36 ft. below No. 18 level, which corresponds with the 2,600 ft. level of the Zinc Corporation mine. This airway is circular and is concrete-lined. Accumulated evidence indicates the existence of a large body of good-grade lead ore under the downcast airway, or 1,000 ft. within the property. Results of work accomplished in the New Broken Hill Consolidated mine indicate that the southern extension of the line of lode will contribute an important addition to the future of the Broken Hill field.

QUEENSLAND

▶ Apart from Mount Morgan, Ltd., which produces copper in conjunction with gold, the state has one large gold mine in operation. Golden Plateau, N. L., at Cracow, west from Rockhampton, has made available the results of work for the year ended June 30, 1943, in which a profit of £A38,550 was earned, despite restrictions on output common to the times. Only sufficient men were available to keep the mine working part time. Ore milled totaled 38,722 long tons, from which bullion was recovered containing 9,522 oz. of gold and 9,468 oz. of silver, the percentage recovery of gold being 93.46. Cyanide treatment recovered 86.63 percent of the gold and 13.37 percent came from corduroy strakes. The orebody is lenticular, and stoping widths varied from 10 ft. to 30 ft., ore being broken below the open-cut horizon by shrinkage stoping. Proved ore reserves were estimated at 88,000 tons assaying 4.73 dwt. gold per ton, and 23,300 tons of probable ore worth 5.2 dwt. per ton, a total of 111,300 tons assaying 4.77 dwt. gold per ton. Costs for the year increased by 7.45d. per ton, but development expenditure was

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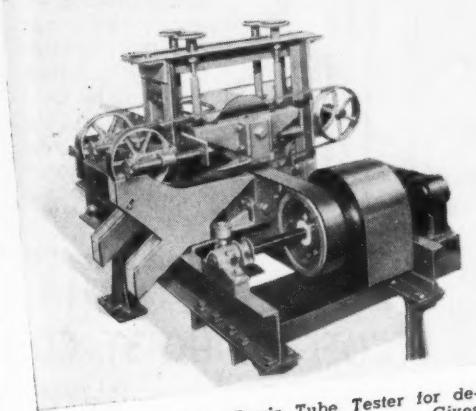
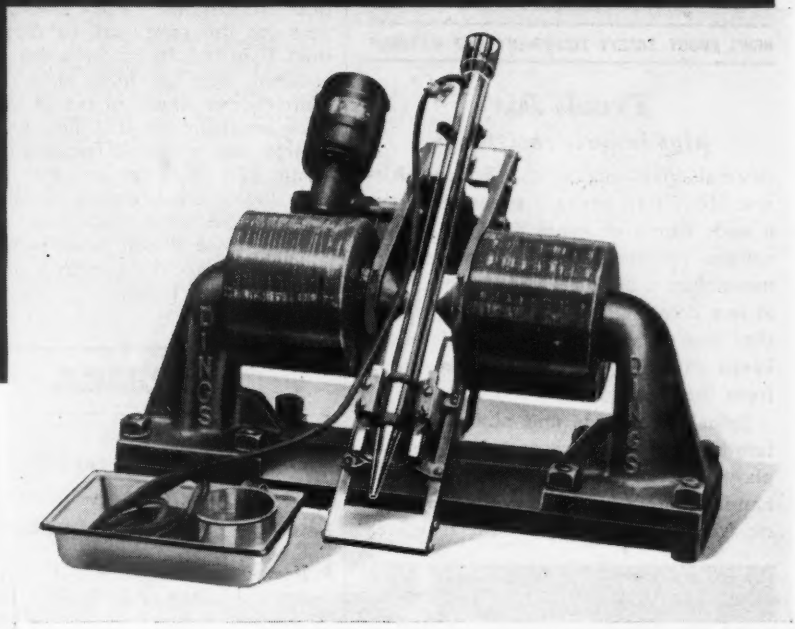
Dings Magnetic Equipment

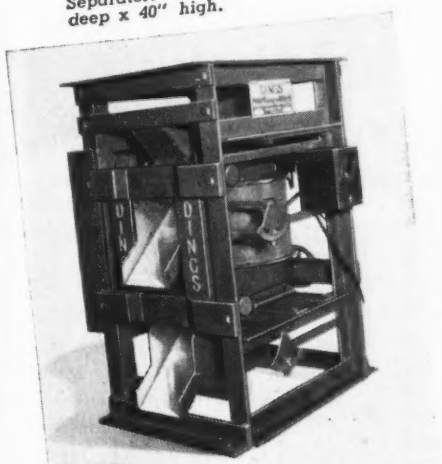


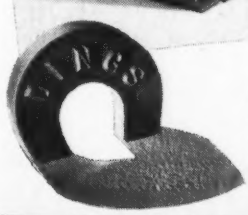


Right—The Dings-Davis Tube Tester for determining magnetic content of ores. Gives quick, accurate answer in 10 to 15 minutes. Shows results obtainable on latest improved wet type separators.

Above—Dings Rowand-Wetherill Type Cross Belt Separator for laboratory use. A two pole unit. 2'-7½" x 7'-3".

Below—Dings Induced Roll Type IR Laboratory Separator. A two roll unit. 29" wide x 22" deep x 40" high.





Left — Alnico Horseshoe Magnet. Very powerful. 2½" wide x 3" high. Pole bases ¾" x ¾"

The units illustrated here are typical of the complete line of Dings Magnetic equipment specially designed for mineralogical laboratories operated by mining companies, Bureau of Mines Stations and technical universities. Dings Separators for laboratory use are usually scale models of commercial machines and will produce results obtainable in commercial practice. They are built to the same high standards of design and quality that characterize all Dings equipment.

In addition to building machines for laboratory use, Dings maintains a completely equipped Magnetic Laboratory for magnetic analysis of mineral samples. This service is rendered free of charge and is available to all qualified individuals or companies. You are invited to submit samples for magnetic test to determine magnetic content, type of separator to use, results obtainable, etc. For full details, write to Dings.

NEW CATALOG—a new catalog, No. 11, is now being printed, giving complete data on Dings Laboratory Equipment and the Dings Magnetic Laboratory. Write for your copy.

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Several adaptions of the Bullard Airline Hood now make it practical to get a wide range of protection on a wide variety of jobs. The Airline Hood is more than a simple respiratory device. It is a combination eye and face shield that guards against flying particles. It keeps irritating, foreign particles away from the skin.

Splashing liquids and non-poisonous fumes found in laboratories, and certain plating and dipping operations may be handled safely with the rubberized fabric Airline Hood. The acetate facepiece

is resistant to light impact; the supplied air removes much of the cause for headaches and other discomforts.

The standard fabric hood has long been used for light grinding, where heavy impact is absent, paint spraying, bulk cement handling and other dusty, particle-laden air. One of the principal features of the hood is the method of air feed. A perforated tube feeds air across the top of the facepiece to keep the window fog-free, and eliminate a direct stream on the face or head.

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Australia *(continued)*

less, due to insufficient labor. Costs were: development, 3s. 3.984d. per ton; ore breaking, 5s. 11.642d.; treatment, 10s. 7.523d.; general expenses, 4s. 4.515d.; total cost per ton, 24s. 3.664d. The company carried out extensixe prospecting work for wolfram at a locality 36 miles from the mine. The lodes explored were for the most part flat-dipping and from 6 in. to 36 in. in width. Values obtained were as high as 8.0 percent wolfram, but shoots of ore of this grade were invariably small. The work done showed that shoots of payable ore were erratic and that the necessity to hand-pick the material broken involved high costs. A treatment plant is to be erected at the Golden Plateau mine so that some contribution to the country's production of wolfram will result.

AFRICA

Production cut planned for Rhodesian coppers — Interest in Orange Free State unabated

▶ It was reported on p. 116 of the February, 1944, issue of *E. & M. J.* that three Rhodesian copper producers, Roan Antelope, N'Kana, and Mufulira, were to cut their production 20 to 25 percent in three stages, beginning on April 1. This was based on British government announcements. It was further reported that the planned expansion of facilities at N'Changa would be abandoned. Late in February, however, the Combined Raw Materials Board, after considering the effect of the first announcement, issued a statement saying that some reduction of copper output was planned in Rhodesia, but that the exact amount had not as yet been decided. The plant expansion for N'Changa will be carried to completion. Reason for considering such reduction in copper output is given as a lack of sufficient transportation facilities in the area. Other, more vital, metals, such as metallurgical chrome, will, it is said, be moved first. In any case, uncertainty over the future demand for copper has generated a good deal of conservatism among Rhodesian producers. Mufulira, Rhodesian Selection Trust, and Roan Antelope have decided to pass the present dividend period without making any payment.

▶ The South African (Transvaal) gold production in 1943 is calculated by the Chamber of Mines to have been 12,800,021 oz. This compares with 14,120,600 oz. in 1942. The decrease in gross value is thus nearly £11,000,000. Evidently the decrease continued in January

▶ As it is expected that a new scheme may be divulged in the forthcoming budget by which the gold-mining companies will be relieved of an additional portion of their earnings, the question of tax relief is again being discussed, if not demanded. Evidently it is not only the producers who are worrying, as a report just issued by the Social and Economic

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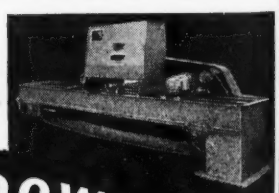

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Our engineers are specialists in sectionalized mining machinery. They know how to lay out complete Rib Cone Mill plants in sections that can be transported by man-power, mules, rafts, and even canoes or camels. This has enabled us to substitute air express when the need is urgent and time is precious. Straub sectionalized machinery is steel constructed throughout for shock resistance and maximum strength without useless weight. That's why we can ship Straub parts over desert or mountain trail, or rush them overhead by plane in emergency.

Naturally, wartime demands have temporarily curtailed Straub air deliveries. But the need for sectionalized machinery in remote locations still exists. Your problem and your inquiry will receive our careful attention. When you write please be sure to give full details—capacity requirements, character of ore, grinding mesh, method of treatment, type of power, transportation facilities, and any other essential factors.

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The illustration shows a shop assembly of one of the many available sectionalized Straub Rib Cone Mills. All Straub sectionalized equipment is completely assembled in our shop before shipment. Following a rigid inspection, every part is carefully marked to guarantee easy assembly in the field, even by unskilled labor. After dismantling, all parts are securely packed to conform to transport specifications. This routine Straub procedure is your guarantee of safe delivery, easy installation and satisfactory performance.

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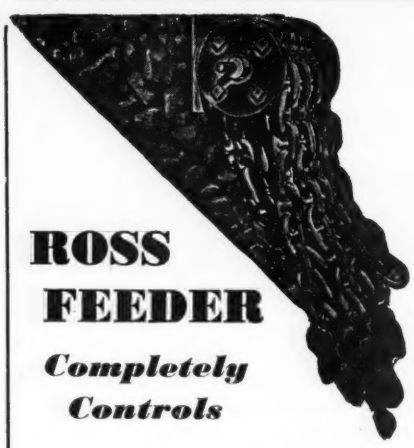

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Africa *(continued)*

Planning Council of the Social Security Committee recommends that the import of capital for productive use be encouraged, and that government policy should be to lengthen the life of the gold mining industry. This certainly implies a fear that a continuance of the present policy on taxation may prevent capital from taking the risk of developing the deep ores of the Witwatersrand. The report includes a recommendation that ultra-deep mining should be encouraged and that a long-term mining policy be adopted. Taxation of one form and another now absorbs somewhere between 50 and 65 percent of the total working profits of the South African gold mines, according to various estimates.

▶ East Rand Proprietary has been endeavoring to isolate a fire which broke out in the stoped area of the 41st level of its mine late in January. At last accounts it was thought the fire was under control. There were no fatalities. Ability to draw from a surplus reserve dump on the surface made it unnecessary to decrease production. Working profit in January was £93,217, against £94,089 in December and £92,608 in November.

▶ Arrangements are being completed for New Union Goldfields to acquire control of Eastern Transvaal Consolidated Mines. The latter was a Sir Abe Bailey enterprise which had been paying dividends for some years before his death. When the Anglo American Corp. took over the Bailey interests it acquired an option to take over Eastern Transvaal Consolidated. This option, it is understood, will now be transferred to New Union Goldfields and that Anglo American will acquire an interest in New Union Goldfields. It is rumored too that certain rights in the Orange Free State are included in the transactions.

▶ Interest in the Orange Free State possibilities shows no sign of subsiding. The number of companies acquiring prospecting rights, options, and property ownership is continuing to increase. Lydenberg Estates No. 8 area is to be drilled, African and European, Anglo American, New Central Witwatersrand, and National Mining having reached an agreement recently to finance the work. Some or all of the aforenamed companies are interested in the reconstruction of Wit Extensions, Ltd., one of the first companies to get into the Orange Free State. Formed in 1933, it acquired options over an area of 68 square miles in the Odendaalsrust district. Presumably most of those options have been disposed of. When reconstructed and financed it will acquire new rights, in agreement with Selection Trust, which has large holdings in the vicinity, by which Wit Extensions will be entitled to 15 percent of whatever is discovered.

▶ Again during the quarter ended December, Blyvooruitzicht opened and sampled 6,305 ft. of Carbon Leader reef, all of which was payable averaging 727 inch-dwt. This is not quite up to the 858 inch-dwt. reported for the September quarter, but is richer than any other development reported from the Witwatersrand.

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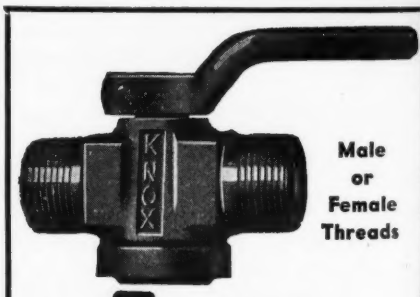

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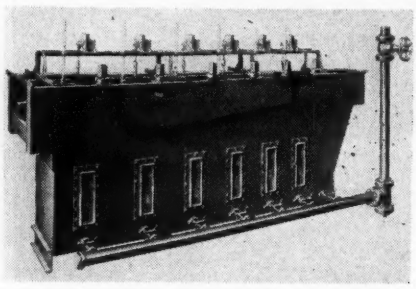
EQUIPMENT NEWS

Automatic Hydraulic Classifier

Developed to utilize fully the principles of hindered-settling classification, the new Dorrco Hydrosizer is said by the manufacturer to provide fully automatic control of a sensitivity unusual in a hydraulic classifier. With the new unit, it is possible to obtain automatic continuous separation of a feed of 4-mesh material and finer into a number of sharply classified products.

The Hydrosizer consists of a tank subdivided into five or more trapezoidal pockets, the areas of which increase from the feed to the overflow end. At the bottom of each pocket is a perforated constriction plate with holes having a diameter



and spacing corresponding approximately to the size of particle to be retained in each pocket. Hydraulic water is admitted under the constriction plates through a pinch valve.

In the center of each constriction plate is a discharge valve, the action of which is controlled by a valve motor, a modulating reversible motor, and the valve motor control, an extremely sensitive pressure-registering instrument that constantly measures the hydrostatic head in the standpipe located in each pocket. Changes in head are immediately transmitted to the valve motor, which raises or lowers the valve plug to compensate for them. When the unit has been adjusted properly, each spigot product is uniform and is discharged continuously. No manual adjustments are necessary thereafter, unless major changes in feed characteristics occur.

To date, the manufacturer reports, the Dorrco Hydrosizer has been successfully applied to the preparation of table feed and specification sand and in concentrating phosphate rock, iron ore, and chromite. Further details may be obtained from The Dorr Co, 570 Lexington Ave., New York 22, N. Y.

All-Weather Welders

Wilson "Bumblebee" a.c. welders are now available in all-weather models of 300- and 500-amp. capacity, according to a recent announcement of Wilson Welder & Metals Co., New York, N. Y. These machines are similar to standard Wilson a.c. welders except that they have special moisture-proof insulation throughout, and all parts are protected by a heavy coating of moisture-proof paint. The outer case is finished in weather-resisting enamel and has gaskets and louvers designed to prevent entrance of rain. The unit is equipped with a low-voltage contactor that automatically holds the open-circuit voltage at approximately 40 volts.

Automatic Recording Gas Analyzer

For close control in chemical, oil refining, and various furnace processes, Cambridge Instrument Co., Inc., Grand Central Terminal Bldg., New York, N. Y., offers a recording gas analyzer that supplies a continuous record of the O_2, CO_2, CO, and H_2 content of the gas in question. A sample of the gas passes continuously through the device, and the analysis is made by comparison of the sample's thermal conductivity with that of a reference gas and by comparing these thermal conductivities before and after absorption or combustion of the sample. Suitable connections between this instrument and process control devices enable automatic operation to be secured. Further details may be secured from the manufacturer.

Locomotive Resistors

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has announced a new type heavy-duty resistor especially designed for use on open-trolley mine and industrial locomotives of sizes between 13 and 20 tons. The new element is not intended to replace smaller resistors for small locomotives, but it is recommended for heavy-duty locomotives. The larger resistor is said to provide more resistor capacity in a given space, to eliminate a number of connections and terminals by reason of the larger number of elements per resistor, to possess large thermal capacity, and to be mechanically strong.

INDUSTRIAL NOTES

Army-Navy "E" awards for excellence in the production of war materials have been given to the following plants: **Hazard Wire Rope** and **American Cable Division, American Chain & Cable Co.**, Wilkes-Barre, Pa.; **E. I. duPont de Nemours & Co.**, Wyandotte, Mich.; **Brown Instrument Co.**, Philadelphia, Pa.; **Worthington Pump & Machinery Corp.**, Harrison, N. J.; **Cochrane Corp.**, Philadelphia, Pa.

Howard L. Stilley, veteran employee of **R. G. LeTourneau, Inc.**, Peoria, Ill., has been promoted to chief field engineer. He succeeds **Ken F. Park**, who resigned recently to join **Caterpillar Tractor Co.** as manager of the sales development division.

Philip A. Lawrence has been appointed purchasing agent of **Nicaro Nickel Co.** and of **Cuban-American Manganese Co.**, subsidiaries of **Freeport Sulphur Co.**, 122 East 42 St., New York, N. Y.

Vulcan Iron Works, Wilkes-Barre, Pa., announces the appointment of **E. J. McSweeney** as president of the company succeeding **E. Perry Holder**, who resigned several months ago to become president of **Wickwire-Spencer Steel Co.**

Harold W. Buns has resumed his former position as supervisor of technical operations in the laboratory of **Stearns Magnetic Mfg. Co.**, Milwaukee, Wis.

Roland Whitehurst, assistant sales manager of **Electric Storage Battery Co.**, Philadelphia, Pa., since 1940, has been appointed sales manager of the company.

BULLETINS

Welding Cast Iron. A 12-page booklet on methods of salvaging damaged cast-iron parts by arc welding has been prepared by C. E. Phillips & Co., 2750 Poplar St., Detroit, Mich.

Chain Belt Drives. Care of chain belt drives is the subject of a booklet just published by Chain Belt Co., 1600 West Bruce St., Milwaukee, 4, Wis.

Wire Rope. The wire-rope conservation bulletins published by Macwhyte Co., Kenosha, Wis.,, are now available in pamphlet form on request to the company.

Filters and Dryers. Elmco Corp., Salt Lake City, Utah, has prepared a bulletin, No. F2002, describing the company's line of continuous-vacuum filters and dryers.

Chlorine and pH Control. W. A. Taylor & Co., 7300 York Road, Baltimore, 4, Md., has released a completely revised 83-page combination handbook and catalog covering pH and chlorine control. Sent free on request, the sixth edition of this work includes non-technical explanations of pH control methods, precautions to be observed, and applications in different fields, as well as a technical discussion of the meaning of pH control.

Air Circuit Breakers. Catalog 1002, obtainable from I-T-E- Circuit Breaker Co., Philadelphia, Pa., includes complete information on selection and construction of the company's low-voltage air circuit breakers.

Diesel Locomotives. The 50-ton diesel-electric locomotives manufactured by General Electric Co., Schenectady, N. Y., are described in bulletin GEA-4133, obtainable from the company.

Pump packing. A guide for the selection of packing is contained in a bulletin published by Greene, Tweed & Co., New York, 66, N. Y. Three dozen different fluids handled in process work are tabulated, and the correct packing for each liquid, gas, and vapor is listed.

Superviors. "Qualities of a Good Boss," a practical, self-rating checkup on 15 outstanding qualities of a good boss, is available from Elliott Service, New York, N. Y.